SNOOPER™

DIAGNOSTIC SOFTWARE MANUAL

MAXA

SNOOPER

SOFTWARE MANUAL

MAXA

NOTICE:

Maxa

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Table of Contents

5 - The Benchmark Menu 15

6 - The Disk Menu 21

7 - The Memory Menu 28

8 - The Video Menu 34

9 - The Test Menu 44

Introduction

1-1 WHAT IS SNOOPER?

Snooper is diagnostic software for the Macintosh. It will help you detect hidden problems in your computer hardware and help you locate the source of intermittent failures. Snooper can also tell you a lot about the machine you are running it on. It has windows that will tell you what processor and coprocessors the machine has and tell you everything that is connected to the machine via the various buses. Snooper will also show you how the machine it is running on compares with other machines for various types of tasks. In short, Snooper will greatly enhance your communication with your machine whether it is healthy........ or not so healthy.

1-2 WHAT SNOOPER IS NOT

Snooper can help you save on diagnostic service costs, but shouldn't be thought of as a 'technician in a box'. Apple-certified technicians have gone through two weeks of in-depth training from Apple Computer and, often, general electronics training. Apple Authorized dealers and service providers also maintain a large library of updated binders with repair instructions geared toward the service technician's advanced knowledge on the subject. They also have tools that most people don't have and don't know how to use. If you are already an accomplished Macintosh technician Snooper will become one of you everyday tools. If you are not an Apple-certified technician you should weigh your knowledge of the subject and the possibility of voiding your warranty before using the diagnostic clues provided by Snooper to rationalize grabbing a soldering iron and going after a bad chip on the motherboard.

1-3 WHAT'S IN THE BOX

You should have received a Snooper Master floppy disk, two serial loopback plugs, and this manual.

1-4 SNOOPER SOFTWARE REQUIREMENTS

The Snooper diagnostic software will work correctly on the entire line of Macintosh computers (provided they are equipped with sufficient RAM to run the program). Snooper does require that the computer under test be running Apple's System software version 6.0.3 or later, and at least 2MB of RAM are recommended, but 1 Meg will be sufficient with early versions of system software. To check the System software version and RAM configurations, select "About this Macintosh" under the Apple ( ) menu. **Figure 1** shows where the information is found in the "About this Macintosh" window.

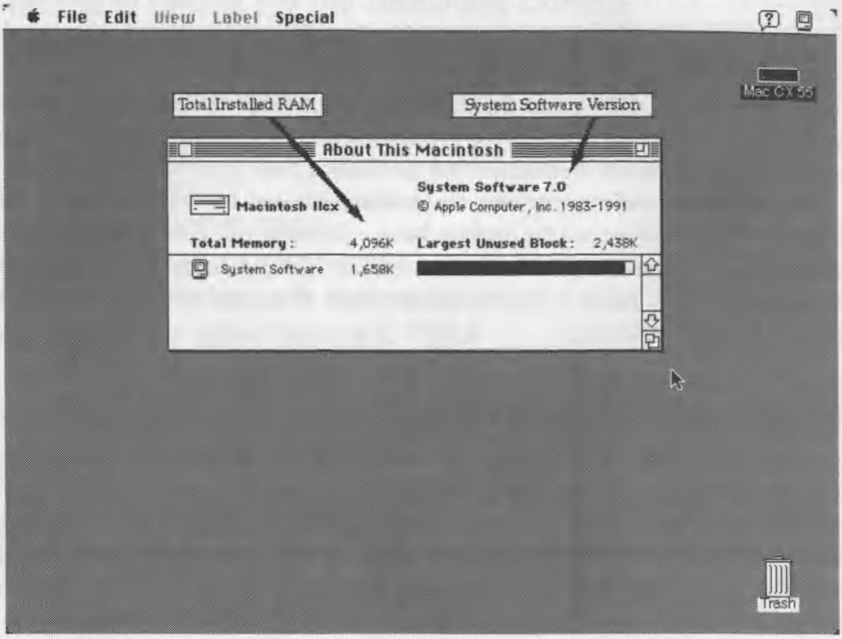

Figure 1. The "About This Macintosh" window.

1-5 REGISTRATION CARD

Before you use the Snooper hardware and software, fill out the registration card and send it to Maxa. Without this card, Maxa will not be able to notify you when updates or upgrades are available. Also, take a few minutes to read the license agreement so you know your obligations.

1-6 MASTER DISK

Make a copy of the Snooper Master disk that is in the sealed envelope. This is inexpensive insurance against loosing Snooper to an unforeseen catastrophe. Because Snooper is diagnostic software, it is assumed that it will eventually be used on a machine that is not functioning correctly. Unhealthy Macintosh computers tend to have a very bad temper, and are prone to corrupting files and other various types of mayhem. If a catastrophe occurs and the copy is damaged, you still have the Master disk to duplicate (on a healthy machine!).

1-7 INSTALLING SNOOPER ON YOUR HARD DRIVE

If you have a choice, we recommend copying Snooper to your hard drive in addition to making the above copy of the master disk. While Snooper runs just fine from a floppy, it can be a little sluggish, just as any other software is that uses lots of windows and pictures. If it is necessary to run Snooper from a floppy, we suggest using a large setting for the RAM cache (Memory Control Panel). This will help reduce the slowness caused by the floppy.

A short note from the Lawyer: Snooper is sold as single user software (contact Maxa for information on group or site licences). It is intended that each "user" have his own copy of the software. If you are a user who is in charge of maintaining a large number of machines, you can use your copy of Snooper on any number of machines so long as you are the only one using it on all those machines. There should be a purchased copy of Snooper for each user of the product, though not necessarily one for each machine.

Getting Started With Snooper

2-1 INTRODUCTION

Snooper is very easy to use (a welcome departure from other diagnostic products that are intended only for use by trained technicians). This section will guide you through a few steps needed to properly set up your machine for use with Snooper. Even if you really know your way around a Macintosh, reading this section will help you avoid some confusion later regarding the tests that require a certain setup in order to function properly. Once these few details are out of the way, we believe that the interface is intuitive enough that most seasoned users will not need to read the rest of the manual.

2-2 SETTING UP THE DISK DRIVES

Because Snooper tests many facets of the hardware on which it runs, there are a few important points about the setup of the computer which you should take note of before you attempt to use the Snooper diagnostic software. First, the floppy drive test writes to the disk that is inserted in the main floppy drive of the computer. You should insert an unimportant, unlocked floppy in this drive with at least 10K of available space on it before starting up the Snooper software. This should be a floppy that does not contain important documents or applications, as the computer under test may be defective in such a way as to destroy the contents of the floppy when written to by the diagnostic software. We cannot guarantee the safety of your data in the event of a major malfunction of the computer or floppy drive during the testing.

While it is much more unusual for a serious problem to occur in writing to a hard drive, some caution should be observed regarding data stored on either internal or external hard drives on a computer that is acting erratically. It is suggested that any SCSI devices not required for the testing be disconnected until the testing has been completed and the source of malfunction has been repaired. This precaution should not be necessary on a properly functioning computer when Snooper is being used for configuration or benchmark purposes.

2-3 SETTING UP THE SERIAL 'LOOPBACK' PLUGS

One setup requirement necessary to complete the full array of tests on the computer concerns the serial ports (the Modem port and the Printer port). Snooper comes with two "loopback plugs" that should be inserted in the Modem and Printer ports when the Snooper software is being used for testing purposes.

These plugs make it possible for each of the two serial ports to "talk to itself" when tested. If the plugs are not used during testing, it will not affect any of the tests that are not related

to the Modem or Printer ports. If these ports are known to be in good working order and the serial port test results are of no interest, the plugs can be left disconnected with no adverse consequences.

Another requirement for proper operation of the Modem and Printer port test is that any other programs which use either the Modem or Printer port need to be disabled while Snooper is in use. This would include modem communication programs, fax modem software, AppleTalk®, music programs, printing, and any other program which makes use of the modem or printer port of the computer to be tested. Again, if you test a computer for other reasons, and do not suspect a malfunction of the Modem or Printer ports, this setup need not be performed. The only drawback will be an annoying message that will appear near the bottom of the Main Screen during operation.

Another related situation can occur (although rarely) that will prevent the serial port tests from being performed. This situation gives the same annoying message as the above situation even after all other serial related software has been disabled, making it appear that you have missed something. The Macintosh has a type of storage called parameter ram (PRAM for short) that stores information even when the power is off. Most of the settings in the "General" control panel are stored in this small amount of permanent memory. There is another setting (not available through the control panel) that controls what the serial ports are used for, and the default speed settings, etc. for the these ports. This information is generally not used for much of anything, but if a strange and unworkable setting finds its way into these storage locations, it can prevent Snooper from using the ports. The only known fix for this problem is to "Zap" the PRAM (that sounds ominous, but it just means set it all to default values that are safe). To zap the PRAM when running System software version 6.0.7, just hold down the command and option keys and hold them while selecting "Control Panels" from the Apple menu. To zap PRAM with System 7.x.x, hold down the command, option, P, and R keys while restarting the computer. Don't bother to do this unless you have disabled all of the serial port software on a machine and still get the annoying message about the serial ports being in use. Zapping the PRAM has the annoying side effect of changing the mouse speed, desktop pattern, etc.

2-4 OPTIONAL EQUIPMENT TESTS

No other particular hardware setup is necessary for the proper operation of the Snooper software. There are, however, a few functions of Snooper that are not available on Macintosh computers that do not contain certain optional equipment. On these computers, Snooper will still operate correctly, as the functions that require hardware that is not present will be disabled and cannot be selected by the user.

One example of this is the video tests that involve color on machines that do not have color monitors. These "color specific" test screens will show up in the Video menu, but they will be disabled (grayed out), and you will not be able to select them.

Another case where this will occur is in the Memory menu. There are menus used for cyclic testing of the RAM memory of the computer. These functions are not available when virtual memory is on (under System 7.0 or with a special utility programs). Whenever you see a menu item that is "grayed out" and cannot be selected, it means that the test or function is not applicable to the computer being tested in its current configuration.

The following sections of this manual give more detail about tests and functions that require a piece of optional hardware or special system software setup.

2-5 SYSTEM SOFTWARE SETUP

Apart from the serial port setup in section 4-4 above, all of the system software setup required by Snooper is accomplished via the "Memory Control Panel" under System 7.x.x. If you are running under System 6.0.x you can ignore this section, as it does not apply to you. If you are using Snooper with System 6.0.x and a third party utility that gives you a RAM Disk (see glossary) or quasi-32 bit mode or Virtual Memory (see glossary), beware that Snooper may not be compatible with that utility software. It is best to disable them while using Snooper.

One of the options available in the Memory Control Panel on those machines equipped to use it is "Virtual Memory"(see glossary). Virtual Memory is only available if your machine has a PMMU chip (see glossary) installed. All Macintosh systems equipped with a 68030 or 68040 microprocessor have a PMMU. Virtual Memory must ON to test the PMMU, and must be OFF to test memory.

Another option in the Memory Control Panel is '32 bit mode'. This mode allows a Macintosh to make full use of up to 128 MegaBytes (1000 times as much as the original Mac 128K). Very few people have the need or the money to install that much memory in their machine, but if you have more than 8 MB installed you need to pay attention to the setting of this option. The memory tests in Snooper will not function properly if you have more than 8MB installed unless you turn on the 32 bit option.

The other important option in the Memory Control Panel that concerns the memory tests in Snooper is the RAM Disk option. This is only available under System 7.x.x and only on some machines. This option MUST BE OFF when using Snooper to test RAM. Using Snooper with the RAM Disk option turned on will disable all RAM testing. This is necessary because the System protects the RAM Disk RAM from being written to by anything else to prevent crashing programs from corrupting the contents of the RAM Disk.

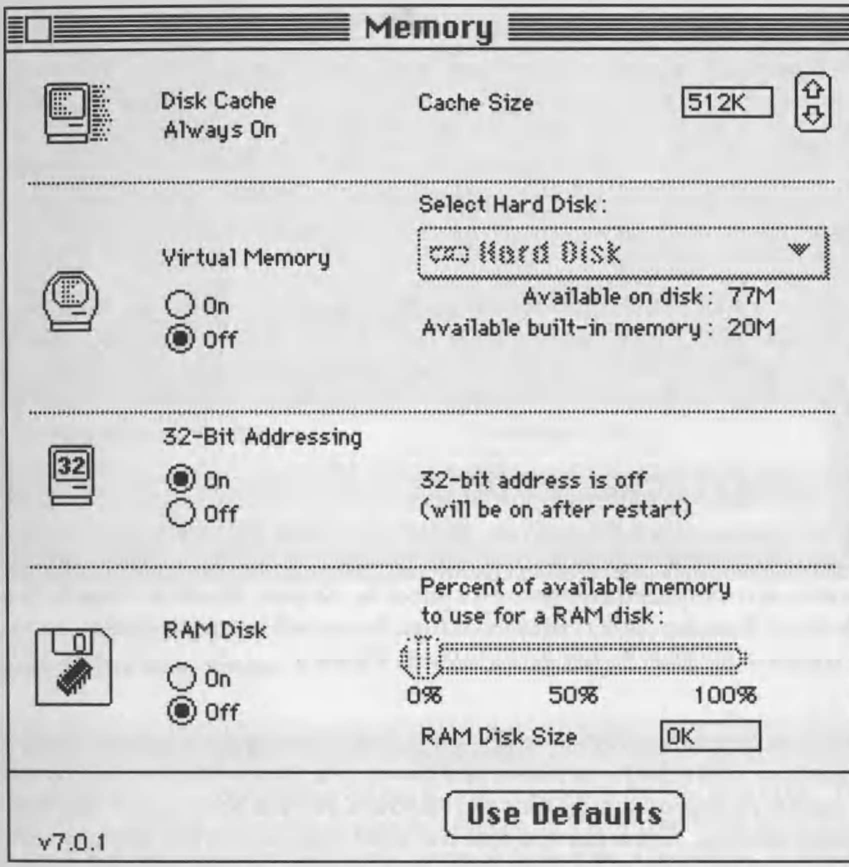

Figure 2. Memory Control Panel in System 7.0.1

The Main Screen

3-1 INTRODUCTION

The screen that appears when you first start up the Snooper application is referred to as the "Main Screen." This screen is always available when the Snooper application is running, although if you are executing one of the tests available from the menus (as discussed in the next few chapters of the manual) the Main Screen may be covered up by other windows. When the Main Screen is the front window (as it is when you first start up Snooper) it will continuously cycle through a series of tests that put most of the major components of the system through their paces.

This Main Screen testing is helpful for "burn in" testing and for testing of a system which exhibits occasional failures. It can also be used to run through all of the major components of the system before using the tests available from the menus to further test specific parts of the system.

3-2 MAIN SCREEN STATUS

As each system is tested, the status area just above its name will blink a question mark to show that testing is in progress, and will then show the results of the test before moving on to test the next subsystem (a subsystem is a part of the computer, like the RAM or the floppy disk drive). Tests that fail or need attention from the user will be noted in the text areas near the bottom of the Main Screen shown below in **Figure 3**.

Once all of the tests have been completed once, the cycle repeats over and over again, with a cumulative error count for each subsystem shown at the bottom of the text area. By noting the cumulative error count at the bottom of the screen, the Main Screen can be used without constant attention. All that has to be done is to let the Main Screen cycle through its testing and occasionally check to see if any errors have occurred. If there were any errors, the malfunctioning subsystem can be further checked with one of the tests available in the menus.

NOTE: There are some bugs in the ROM of early machines and early System software that prevent the self-test mode of the keyboard and mouse from functioning correctly. For the most part, these problems are confined to the Mac SE, and System versions prior to 6.0.7. We will be trying to find work around methods to make these tests function despite the buggy system code in future versions of Snooper.

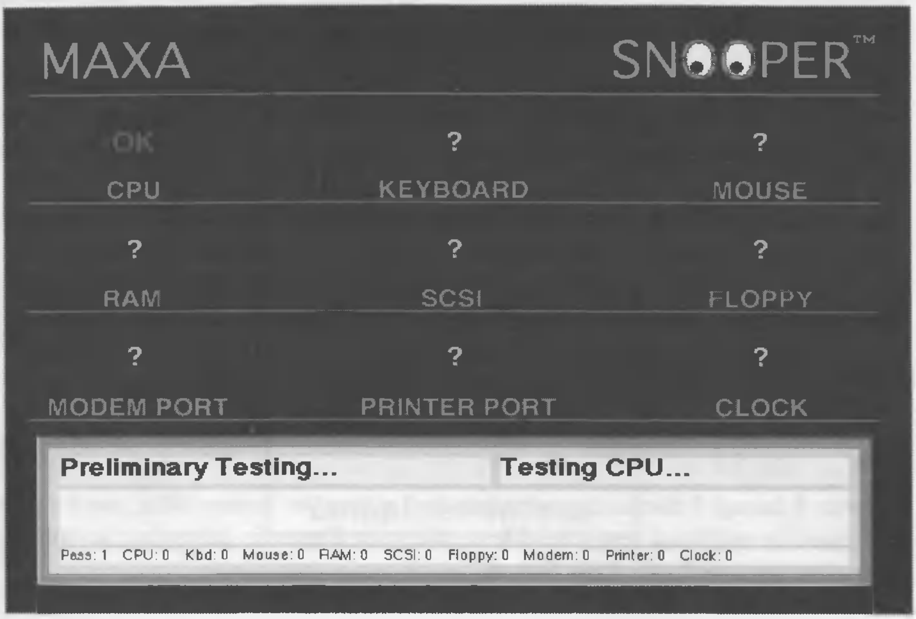

Figure 3. The Main Screen.

3-3 TEMPORARY TESTING HALT

You can temporarily stop the Main Screen testing by selecting the first item in the "Test" menu. This menu item allows you to stop and continue the testing done in the Main Screen. This does not disturb the cumulative error counts at the bottom of the screen. When Main Screen testing resumes, the test simply continues from where it left off. The only way to reset the error totals is to quit the Snooper program and restart it.

3-4 MISSING LOOPBACK OR FLOPPY DISK

As mentioned in Section **2-3**, if there is a message in the text area which identifies missing loopback plugs or missing floppies, they can be ignored if those system components are not suspect. Snooper will skip those tests and continue to display the message. The memory test will also be skipped if virtual memory is on. Any conditions (such as a missing floppy) that prevent a test from being performed simply leave a question mark in the status area for that test and alert the user with a text message. Skipping a test does not increment the error total for that subsystem.

The CPU test does some math with the CPU (not the FPU if present). The keyboard and mouse tests test use the internal self test of ADB keyboards and mice. Non-ADB keyboards and mice (i.e. Mac Plus and earlier machines) are not tested by Snooper. The RAM test does a simple static test of RAM (more exhasustive RAM tests are available under the Memory menu). The SCSI test simply checks to see if all connected SCSI devices are responding to read commands. The floppy test is a read/write test that checks speed, accuracy, and errors. The Modem and Printer port tests check the handshaking lines and check data transmission at 2400 baud. The Real Time Clock Test just makes sure the RTC is ticking, and that it will accept read and write commands.

3-5 WHERE TO FIND MORE INFO

The technical specifics of the testing done by the Main Screen can be found in Chapter **10** of this manual entitled "Technical Details for the Terminally Curious."

3-6 WHAT'S NEXT

Chapters **4** through **9** discuss the commands each of Snooper's menus offer, one at a time to explain the additional tests available to take your diagnostic debugging beyond the general testing done by the Main Screen.

Info Menu

4-1 INTRODUCTION

One of the many uses for the Snooper software is to determine quickly what has been installed in a Macintosh computer system without the need to "open up the hood" and take a look. The choices available from the "Info" menu, shown in **Figure 4**, are used to obtain this information about the computer.

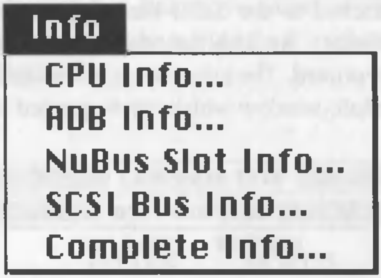

Figure 4. Contents of the Info menu.

4-2 INFO MENU: CPU INFO

The first menu choice in the "Info" menu is "CPU Info." This menu choice displays a window that shows configuration data that is more specifically related to the Macintosh's motherboard. It does not include any information about the various busses in the computer. This window cannot be printed or saved for later reference, but all of the information contained in this window is also available in the Complete Info window, which can be saved or printed. Use the CPU Info menu choice when you just want to quickly check on a specific CPU related configuration option without wading through the other information available in the Complete Info window.

4-3 INFO MENU: ADB INFO

The "ADB Info" window displays all available information about ADB devices connected to the computer in a table format. Like the CPU Info window, this window cannot be saved or printed. The important information in this window is, however, also available in the Complete Info window which can be saved or printed. This window is useful when you are only interested in determining the ADB configuration of the machine without wading through the other information shown in the Complete Info window.

4-4 INFO MENU: NUBUS SLOT INFO

The NuBus Slot Info menu choice opens a window that shows the contents of the NuBus expansion slots on machines that support NuBus cards. The information in this window is provided for a quick look at the NuBus without any distraction from other information available in the Complete Info window. If you wish to 'Print' or 'Save' the information about the NuBus you will need to do so with the Complete Info window.

4-5 INFO MENU: SCSI BUS INFO

The "SCSI Bus Info" menu item allows you to display a window that shows details regarding the devices attached to the SCSI bus of the computer without any other information to cloud the issue. As with the other specific information windows, this window cannot be saved or printed. The information it contains, shown in **Figure 5**, is also available in the Complete Info window which can be printed or saved.

SCSI Bus Info

SCSI Bus Info 2/10/92 8:07 PM

SCSI Address:	SCSI Device Attached:
0	MAXTOR LXT-213S
1	...Empty Address...
2	...Empty Address...
3	...Empty Address...
4	...Empty Address...
5	APPLE PERSONAL LASER
6	...Empty Address...
7	Macintosh CPU (Bus Master)

Figure 5. SCSI Info window.

4-6 INFO MENU: COMPLETE INFO

The last choice in this menu, "Complete Info," provides the user with an overview of the configuration of the system. It provides, in just one screen, most of the details about the

hardware and system software currently in use in the machine. By selecting this menu command you can determine the type of microprocessor in the machine, the clock speed of the microprocessor (CPU), and whether or not there is a math co-processor or a PMMU (Paged Memory Management Unit) installed. This window also shows what devices are connected to the ADB port, the SCSI port, and the NuBus expansion slot(s) (if the machine supports one).

To save or print this window, select 'Print' or 'Save as' from the "File" menu when this window is the front-most window. The 'Print' and 'Save as' choices in the "File" menu are only available when the front-most window on the screen is one of the two that can be saved or printed. The other window that can be saved or printed is the Complete Test window which is covered in a later chapter. See the Complete Info window in **Figure 6**, and the "File" menu in **Figure 7**.

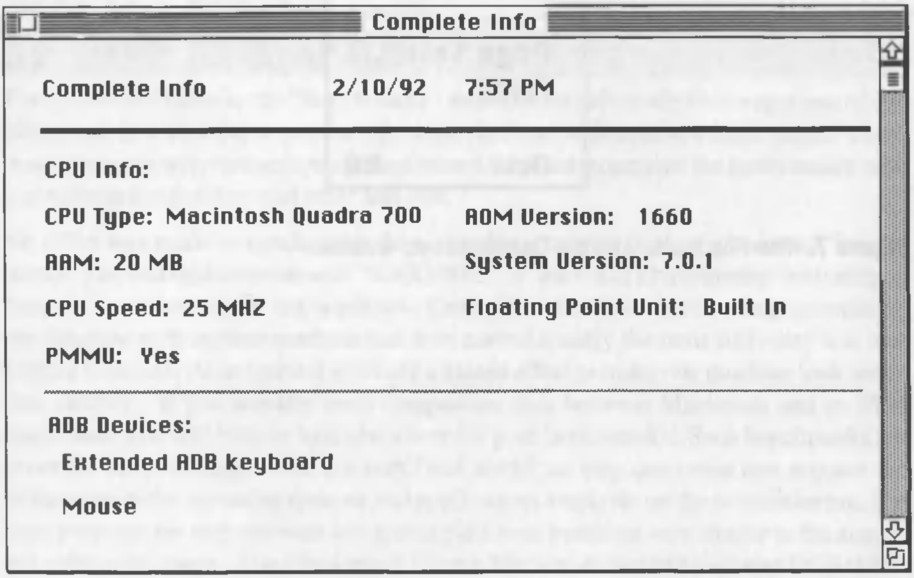

Figure 6. The Complete Info window.

This window also provides a convenient way to record the current configuration for later reference, as this window can either be printed or saved to disk for later display by the Snooper application. This ability to 'Print' or 'Save' the Complete Info window provides a simple method of maintaining records of the configuration of a large number of machines for insurance or other record keeping requirements. The file that gets saved by Snooper

can be opened by Snooper using the 'Open' command in the File menu. The file is a 'TEXT' file, so it can be opened by most word processors as well, or imported into a spreadsheet for maintaining a database of configuration for a large number of machines.

Figure 7. The File menu with the Complete Info window.

Benchmark Menu

5-1 INTRODUCTION

The tests found in the Benchmark menu all deal with how fast the machine is. A Benchmark is a test that performs some operation (usually a large number of times) and gives some type of performance number based on the amount of time it took the machine to complete the operation. From the dawn of the computing age this method has been used by both users and manufacturers to say "My Machine is Faster Than Yours!" It is likely that in the days of the Abacus (a Chinese invention used for counting and doing arithmetic involving moving beads up and down on rods held in a frame, basically a large extension of the idea of counting on ones fingers), wealthy traders had benchmarks used for comparing one "accountant" with another. They were probably timed with water dripping through a hole in a bowl. The benchmark tests performed by Snooper are somewhat more sophisticated than that, but use the same basic principle.

5-2 APPLES TO APPLES

The tests available under the "Benchmarks" menu are intended only for comparison of one Macintosh to another, or to compare the same machine with itself at various times. These may also be run with various optional equipment installed to compare the performance with and without accelerators and other add-ons.

No effort was made to synchronize these benchmarks with "industry standard" benchmarks. You will find no mention of "VAX MIPS" or "Sieves of Eratosthenes" (two alleged industry standards) in the test windows. Cross-platform benchmark testing (comparing one machine with another machine that does not run exactly the same software) is at best a tricky business. At its worst it is simply a biased effort to make one machine look better than another. If you actually need comparison data between Macintosh and an IBM mainframe, you will have to look elsewhere for your benchmarks. Such benchmarks are generally acknowledged to be not very "real world" as they don't take into account the differences in the operating systems and applications available on the two platforms. For most purposes the only relevant test across platforms would be very similar to the abacus test mentioned above. You could take a veteran Macintosh user and a veteran DOS (DOS is a type of "system software" used on IBM and compatible machines) user with the best program available for the task to be performed and precisely state the operations to be performed and see which finished first, or how much water dripped out of the bowl. It might be fun to do, and you could probably sell tickets to the event and have cheer leaders and the whole bit, but that would be about the extent of its usefulness.

Snooper's intent is to provide a means to determine how much speed improvement is provided by faster CPUs and accelerator options on normal everyday types of computing, and to provide a means to compare Apples to Apples. The comparison scale for these tests

is based on the performance of a Macintosh Quadra 900, the fastest stock Macintosh at the time of this release, as 100%. That is, execution of this test on an unmodified and fully functional Quadra 900 will yield a score of 100. The last 4 selections in the BenchMarks menu allow you to change this comparison standard. Selecting one of the other machines as the basis of comparison will allow you to compare your machines performance to a stock machine of the selected variety. Selecting a different machine as the basis for comparison does not change the basis of comparison for the 8-Bit Color Benchmark or the 24-Bit Color Benchmark. These two tests are always compared to internal video on a Quadra 900.

If you are still curious about what is really being tested in the benchmarks, there is a section with all of the sordid details in Chapter 10, "Technical Details For The Terminally Curious" later in this manual.

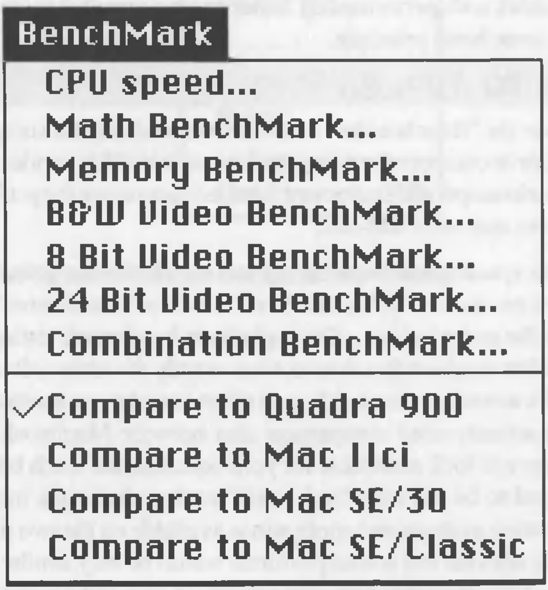

Figure 8. The Benchmark menu.

5-3 BENCHMARK MENU: CPU SPEED

This test checks the speed of the Macintosh main system clock, to see that it is working as advertised, and that your Macintosh is running up to speed. This clock provides the signal that synchronizes all of the activity of the CPU, the RAM and ROM. Don't confuse it with the real time clock that keeps track of the time and date. While failure of the clock is an unusual occurrence, it is possible for the oscillator of the Macintosh to operate at a frequency different than that intended (or advertised) by the manufacturer.

One way the speed can be wrong is if the crystal that forms the basis of the oscillator circuit gets damaged through physical vibration or impact. This will usually result in failure of the crystal altogether, and a "dead Mac", but a frequency shift is possible. Other uses for this test are to see if an accelerator card is really operating at its advertised speed, or to see if the accelerator is installed and functioning without opening the case.

5-4 BENCHMARK MENU: MATH BENCHMARK

The Math Benchmark, as its name implies, puts the machine through a rather excruciating quiz, and times the Macintosh's calculations. This test performs an approximately equal amount of integer math (that means math with no decimal points) and floating point math (both single and double precision). This test also allows the user to select whether or not to use the optional floating point processor on machines that have a math chip installed. You can select and deselect the Floating Point Math Chip option at the top of the window, shown in **Figure 9**, to compare the math speed with and without the math co-processor. This will give you some idea of the difference in performance with a math co-processor installed. On slower machines, the difference is rather amazing. Some of the early machines get a score around 2% on this test.

You should keep in mind, however, that many programs don't take advantage of the Floating Point Unit. Unless you use one of these programs, you are not likely to notice any difference in the speed of your normal everyday tasks as a result of a math co-processor. The results of this part of the benchmark analysis are particularly relevant to users who do a lot of work with spreadsheets, programs that perform calculations to transform an image in a certain way (like a 3D rendering program), or any other very math intensive software.

One interesting note about this test is that despite the fact that your machine is sometimes referred to as a "computer", normal everyday use of computers actually doesn't involve very much "computing" in the strict sense of doing arithmetic. Unless your use of the machine includes specifically math oriented programs such as those mentioned above, you might as well call your machine a "number-mover-arounder-and-pretty-picture-maker" and ignore the results of this benchmark.

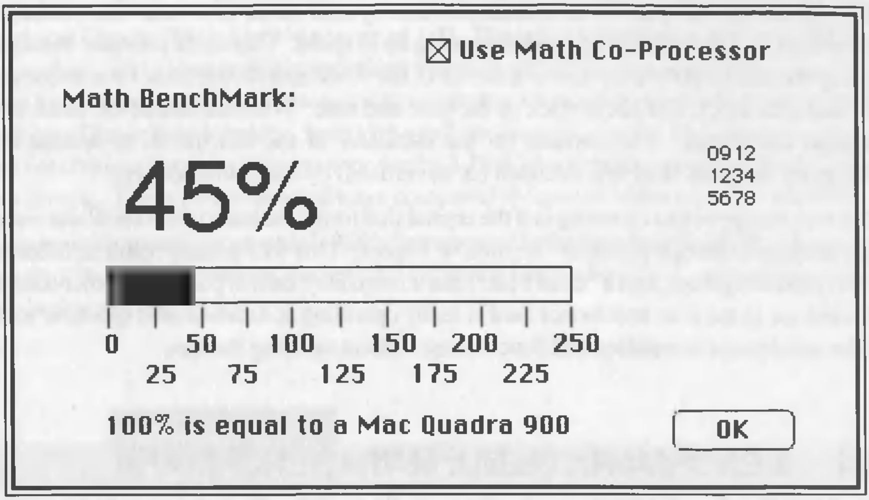

Figure 9. Math Benchmark window.

5-5 BENCHMARK MENU: MEMORY BENCHMARK

This benchmark is the most universally applicable of all the benchmarks, as all applications spend some of their time moving information around from one part of memory (RAM) to another. Whether it be a spreadsheet, a word processor, or a game, it will move pieces of data around from one area of memory to another. The speed with which the machine accomplishes this task has an enormous effect on its overall performance. The primary hardware issues which govern the machine's ability to score on this benchmark are the CPU speed, and the amount of "caching" (see glossary) that the microprocessor performs.

5-6 BENCHMARK MENU: B & W VIDEO BENCHMARK

This benchmark tests the speed with which the Macintosh performs QuickDraw (see glossary) drawing (such as drawing rectangles and lines on the screen), and the speed with which it moves graphic images around. Much of the "drawing" that occurs in Macintosh applications is actually "copying" an arrangement of bits from one area of memory to another rather than calculation of a series of pixels (see glossary) to change in some way. The test is actually performed "off screen" in an imaginary window, so none of the actual benchmark drawing is observable on the screen.

The screen drawing that goes on in the window actually occurs between the testing, and

is purely for the entertainment of the user. All of this test is done in single bit per pixel (see glossary) "Black and White QuickDraw". If you have an 8 or 24 bit video card and monitor, you should use the benchmark tests described in **5-7** and **5-8** respectively.

This benchmark, like the memory one above, is generally applicable to most work done on a Macintosh. Even if you have a color Macintosh, much of the screen drawing actually uses the old "Black and White QuickDraw" routines.

5-7 BENCHMARK MENU: 8 BIT VIDEO BENCHMARK

This tests Color QuickDraw in 8 bit mode. If you don't (or can't) set your Monitors Control Panel device to 256 colors before launching Snooper, this test will not be available.

The window you see on your monitor with this test is much more interesting than the B & W Video Benchmark. Colors and patterns are drawn inside a portion of the window for a short period of time. After the drawings are complete, a comparison percentage to a Macintosh Quadra 900 (operating with internal video as opposed to through a video card) is indicated in the upper left section of the test window. As with the other tests, this was chosen as the basis for comparison because it is the fastest "stock" Macintosh video available at this time. Our tests actually show it to be substantially faster than the same machine with the fastest available "accelerated" video cards. Don't be surprised if your machine rates fairly low on this test; the Quadras are "wicked fast".

5-8 BENCHMARK MENU: 24 BIT VIDEO BENCHMARK

This test rates Color QuickDraw in 24 bit mode. If you don't (or can't) set your Monitors Control Panel device to 'Millions' of colors before launching Snooper, this test will not be available.

The drawing done in this window is identical to and uses the same commands as the 8-bit Video Benchmark above. The only difference between the two windows is the calculation of the performance score, since it generally takes longer (even with a Quadra) to draw something in 24-bit mode that in 8-bit mode. The colors are different because of the different video mode used.

If you have 24-bit color capability, you can trick Snooper into comparing the performance between 8-bit mode and 24-bit mode by changing the video mode (using the Monitors Control Panel) after the 8-bit or 24-bit video benchmark window is already open. When you return to that window it will recalculate the performance based on the new Monitors setting. By performing this little bit of trickery you are calculating 8 bit and 24 bit performance with the same "fudge factor" (the math used to compare this performance with the Quadra 900), so the numbers are relevant to each other rather than to the Quadra 900. This same idea can be used to compare the performance at other pixel depths all the way down to Black and White.

5-9 BENCHMARK MENU: COMBINATION BENCHMARK TEST

This benchmark, as you might guess, combines the tasks done in the other benchmarks into a consolidated "average." This benchmark was designed with the intention to approximate an overall performance measure that would be representative of "typical" use of a Macintosh. Obviously, as with any generalization, this is not particularly relevant to any one user, and may be less appropriate for your use of the computer than one of the other individual benchmarks.

Because not all Macintosh computers have color video, but all of them support Black and White video (and use it for many things even if color is present), the combination benchmark does not include any performance based on color drawing.

This window, like the Math Benchmark window, has a control for turning the Floating Point Co-Processor on and off. This control only shows up if the machine being tested has an FPU.

Perhaps the best use for this benchmark is as a single number with which to compare current performance of a specific machine with past performance to identify a decline (or improvement) in performance over time. Such a reduction (or improvement) in performance would usually be due to a change in the system software or other low level software in the computer such as device drivers (software that interfaces hardware devices with the computer) or INITs (see glossary).

Note: All of the benchmark tests are affected by mouse movement and background activity (i.e. background printing or a fax modem sending or receiving a fax, etc.) This is unavoidable, but also points up the fact that people who nervously move the cursor around on the screen while waiting for the computer to do something are actually slowing it down and making it take longer!

Note: Having Virtual Memory turned on on those machines that support it can also slow down the computer and cause lower scores on the Benchmark tests -- even if there is no Virtual Memory related disk activity occurring!

Note: Some INITs and CDEVs can also slow down a machine and lower its Benchmark results.

Note: Using the internal video on machines that are equipped with it will have an impact on some of the Benchmark results. The Quadra 900 and Mac IIci that the comparison values are based on were using internal video.

The Disk Menu

6-1 INTRODUCTION

This Snooper menu, which is shown in **Figure 10**, is devoted primarily to tests that check various aspects of a SCSI disk drive connected to the Macintosh. The last item in this menu brings up a window used for extensive testing of floppy drives.

The first menu choice is used to select one SCSI disk drive on which to perform the remaining tests. Until you have chosen a drive to test, most of the menu choices in this menu are grayed out and cannot be selected. Once a drive has been selected, the rest of the choices in the menu become available, and perform their tests on the selected drive.

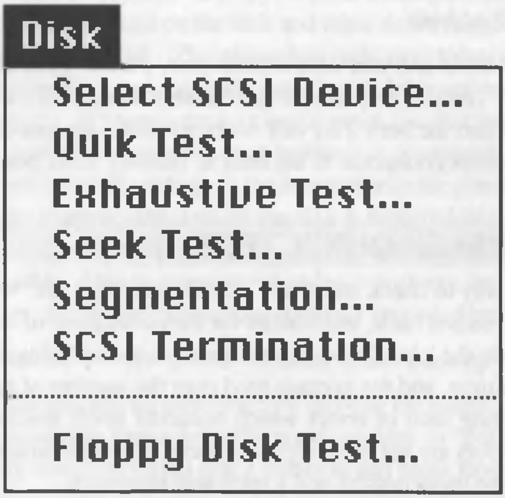

Figure 10. Disk menu.

6-2 DISK MENU: SELECT SCSI DEVICE

When you select "Select SCSI Device" from the SCSI menu, all of the mounted hard disks will be given as possible selections. If a disk does not appear on the Desktop, it will not appear as a drive available for testing. Therefore, password protected drive partitions will remain untested. The only way the tests can be run on a protected partition is if the correct password is entered and the protected partition appears on the Desktop.

If a drive has been "partitioned" (see glossary) such that different parts of it show up as separate icons on the desktop, each partition will show up in the selection window, and the various partitions will be tested as if they are separate drives. The Exhaustive test will test the entire disk, regardless of which one of its partitions was selected.

One important note is that in order to make it easier to identify SCSI drives, they are listed by their Finder name (i.e. the name you gave the drive, which shows up beneath its icon on the Desktop), rather than by SCSI address. This is normally the best way to refer to a SCSI drive, but it can create some confusion if one or more of your drives has more than one partition.

Some SCSI drives may not appear in the list if they are damaged badly enough. There may also be a conflict between SCSI IDs. If two drives are assigned the same SCSI ID number, neither will show up in the selection window. If you think this may be occurring on your system, check the manual that came with the hard disks in question for information on changing their SCSI address.

If the drive you select is one that uses a third party NuBus card for connection to the computer, the Quick Test will be available and the Segmentation Test will be available, but the Exhaustive Test and the Seek Test will not be available for that drive. These tests are available only for drives connected to the built in (native) SCSI port on the Macintosh.

6-3 DISK MENU: QUICK TEST

This test is a quick way to check on a drive's condition. This test writes a small amount of data to the disk, reads it back, and checks for the correctness of the retrieved data and how long it took to do the job. The results are given in units of MegaBytes/second for the read time, the write time, and the average read over the number of passes that have been completed. A running total of errors which occurred while reading or writing is also displayed. These errors are not catastrophic failures, but rather instances where a read or write was found to be unsuccessful and a retry was necessary.

Running this test periodically on a drive will identify any decrease in performance over time. If the number of errors or the time required to read and write go up significantly from one test to another, it is a strong indicator of an impending disk disaster. If you see this happening with a drive, it would be a good idea to back up the data on the disk immediately and start saving for a new one. If the drive is still under warranty, cash in on it quick. While errors that require retries are somewhat common on properly functioning floppy disk drives, they are rare in the extreme with hard drives because of the error correction scheme employed by vendors of SCSI drives. If a hard disk is exhibiting some errors in this window, it is not long for this world, and would qualify as "busted" even if it is still limping along.

Another use for this window is as a "benchmark" of sorts for hard disks. When used in conjunction with the Seek Test window, it provides all of the data needed to compare one SCSI drive with another. By the way, it is quite normal for the write speed of a drive to be considerably slower than the read speed. This is due in part to the verification that happens automatically when writing to a SCSI drive.

6-4 DISK MENU: EXHAUSTIVE TEST

This test starts out with a warning dialog asking you if you REALLY want to perform the test. The reason for this is that it is not inherently damaging to either the disk drive or the data on it, but of all the tests in Snooper, this one has the greatest potential for loosing data when used on a flaky drive or flaky computer. There are two things which make this test "dangerous" on a flaky system. First, the test reads and writes to THE WHOLE DISK, not just to the parts of the disk that are reserved for your files. Some parts of the disk are reserved for keeping track of the data stored on the disk and other data that the operating system of the computer needs to use the disk. This test writes right over top of this data, and then if every thing works correctly, it puts back the data that it clobbered before going on to the next sector (see glossary). If the process works correctly, the disk will have all of its data intact after the test (even if you abort the test before it is complete). If there is an error, however, you might end up with garbage in the area that tells the computer where you files are on the disk. If that happens, the data on the disk is usually lost forever. Second, this test uses a method of talking directly to the disk drive without the intervention of the system software of the computer. This is necessary in order to perform this low level test, but it goes around the sanity checks and protections normally provided by the system software.

To put it bluntly, don't use this test unless you need it, and back up the data first.

It is recommended that this test be performed by moving the suspected drive to a known good machine and then using Snooper on the good machine to “put the drive through its paces.” This is a very complete test in that it writes to and reads from every usable sector on the disk, over and over, for as long as you let the test run. While a few passes through a disk with this test will not damage it, if you were to let this test run for several days, it would probably lessen the life of the drive somewhat.

Another thing you should know about this test is that because it is so thorough, it is SLOW! One pass through a 30 Megabyte hard drive will take over two hours. If you start the test and don't want to finish it, it can be aborted at any time without consequence.

The test window shows the progress of the current pass, the number of passes completed (i.e. the number of times the entire disk has been tested), and a running total of errors during the testing. Unlike the errors noted in the Quick Test, these errors are complete failures of a read or write to a particular sector on the disk. We would not consider a drive that gets even a single error in this test to be a safe place to store important data.

For data safety reasons, this test is disabled when Virtual Memory is on.

6-5 DISK MENU: SEEK TEST

This test sends the disk heads on a wild goose chase, and reports on the time it took to perform the head movement. It moves the heads around in a random fashion, and shows the average time required to move the heads from one place on the disk to another. This is an important aspect of a drive's performance, and in general has a larger effect on system performance than the read and write speed of the drive in normal use. The results of this test are displayed in the Seek Test window, as shown in **Figure 11**.

This test can be used either as a benchmark test for a drive or to look for performance degradation over time. The act of "seeking" on a drive entails much more than just swinging the head over in the correct area of the disk. There is circuitry built into the drive that uses information stored on the disk to determine EXACTLY where the head is. If this mechanism is deteriorating, it can take substantially longer for the heads to get to just the right place on the disk and complete the seek. A change in this number over time is a good indication that the drive will fail soon. This test is like the game of golf; a lower score is better than a higher one.

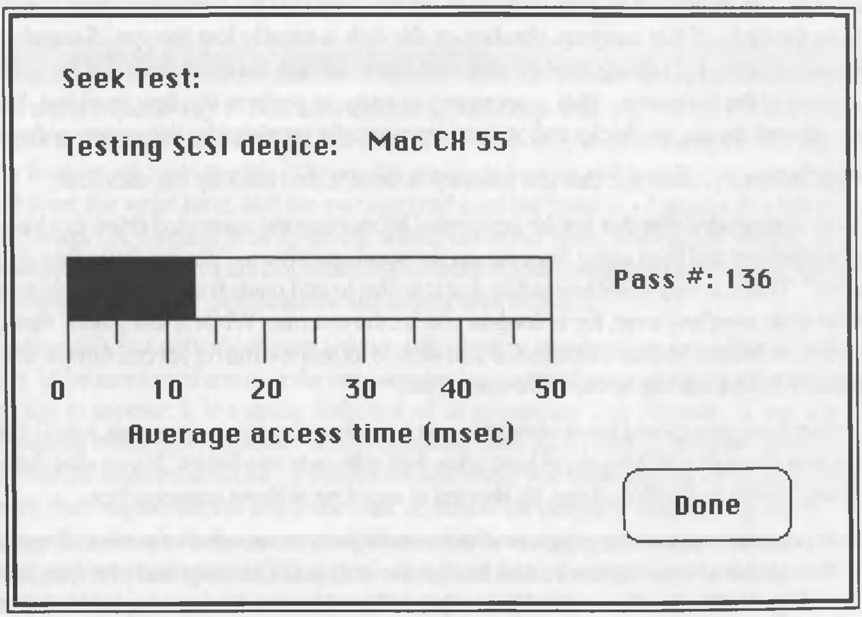

Figure 11. Seek Test window.

While the number given for the average time may not quite agree with the manufacturer's stated access time (like many industry standards for performance testing this one isn't very standard), it is still a good comparison figure to use on several drives to determine their relative seek speed. It is also a good way to detect the reduction in performance of a drive over time.

This test is, by the way, a good test of the power supply in an external drive. If the drive's power supply can stand up to 5 or 10 minutes of this test, it is fit as a fiddle. While a disk drive should be able to seek indefinitely, this test could be hard on an old drive if continued for extended periods of time.

We do not recommend this particular test for "overnight burn in testing" because the functional life of the drive would be greatly reduced. A few seconds of testing will tell you what you need to know - 10 minutes is a good hard workout for the drive. If you need another way of deciding how long to use this test, we suggest that you start the test going and then do push-ups or sit-ups until you are tired, then stop the test. The seek test is about the same level of work for the drive as the sit-ups are for you.

6-6 DISK MENU: SEGMENTATION TEST

This test looks at the contents of the disk and determines the degree to which the data is segmented. Segmentation, or 'fragmentation' is the percentage of the files on the disk that require more than just track to track head movement. When a file is stored to disk, it is usually placed on the disk in consecutive sectors and tracks. However, if the file is later increased in size, the additional room is obtained from a nearby empty spot on the drive instead of moving the whole file to a larger area on the disk. A part of the disk's directory called the "extents tree" keeps track of the location of the additional data which has been spread throughout the drive.

After this has occurred several times, portions of a file will be stored in various random locations on the hard drive. This can require extensive head repositioning to read in the whole file and slow the performance of your drive. When this test yields a segmentation result of more than 10%, the hard drive is said to be badly segmented. While this version of Snooper does not 'defragment' your files, it will at least tell you that the condition exists so that a hard disk utility can be used to remedy the situation.

6-7 DISK MENU: SCSI TERMINATION

This test checks to see if any SCSI errors are occurring as a result of poor or nonexistent bus termination. The terminators used on a SCSI bus (at the beginning and the end of the chain - in theory) are like shock absorbers for the high frequency signals that travel on the bus. When a high frequency electronic signal moves along the SCSI cable chain, it can "reflect" from the end of the wire and travel back towards the beginning. If the bus is

properly terminated, the signal is absorbed at the end of the cable and does not reflect back. Reflections in the cable tend to act as noise, and reduce the reliability of the data sent on the bus. In addition to the above good result of termination, too many terminators will effectively reduce the signal level of the "good" signals traveling along the bus, so the idea of "the more the merrier" doesn't apply here.

In a simple SCSI configuration with just one or two SCSI devices, the termination guidelines set forth by Apple in the various users manuals work well. In a system with more devices on the bus, termination becomes a black art that is fraught with frustration can lead to much "weeping and gnashing of teeth". This test can help in the trial and error process of determining the proper termination of a complicated SCSI setup.

6-8 WHAT TO DO WITH A BAD HARD DISK

Usually the only way to fix a hard drive is to replace it. They are sealed units built under clean-room conditions, and cannot usually be fixed unless the problem is a bad control card or another component outside of the disk's hermetically sealed enclosure. Service centers don't mess with replacing controller cards and such. If a drive is under warranty, they will usually RMA (Returned Merchandise Authorization, it means send it back to the guy who built it and have him worry about it) the drive. Most service centers have a pile of bad hard disks in a corner that is two or three feet high. Such a pile can be an entertaining archeological find. The ones at the bottom have the smallest capacity and weigh several times what the newer higher capacity drives do. Like many things in the computer world, hard drives always get smaller, cheaper, and faster over time. If your hard drive is looking a little green behind the gills, do yourself a favor and buy a new one that holds twice as much data and gives it back twice as fast and costs half as much.

6-9 DISK MENU: FLOPPY DISK TEST

This test allows you to check the condition of the floppy drives connected to your Macintosh. Like many of the tests available in Snooper, this test is repetitive, and continues to cycle through the test as long as the window remains active. Before you start this test (or after being hounded by an obnoxious message in the window) you should insert an unlocked floppy disk in the drive to be tested. Make sure the disk has no important data on it and that it has at least 10K of available space for Snooper to use. While Snooper does not intentionally destroy any data already on the floppy, we cannot be held responsible for the actions of a malfunctioning disk drive.

The test consists of writing a small amount of data to the disk, reading it back, comparing the data written with that read back, getting rid of the test file, and checking the time it took to perform the test. The display gives its results at the end of each pass of the test, and shows a "normal" zone for both 800K and 1.4MB floppies. If the floppy is performing normally,

the bar display will be in the normal zone or above for that type of floppy. The test result is based on both the speed with which the drive completes the task and the errors (retries) that occur during the test. Retries are not uncommon with floppies, but if they get excessive, it indicates poor performance and impending doom.

If the performance falls outside the normal range during testing, you should try a different floppy before you condemn the drive. More often than not the floppy will be found to be the culprit rather than the drive. If several floppies show the same poor performance, then the drive in question probably needs cleaning, calibration, repair, or all of the above. If the drive just needs cleaning, try one of the products available from a computer dealer for cleaning the drive. More extensive problems should be handled by a repair center. Unlike hard drives, floppies can usually be repaired or readjusted to function properly.

The Memory Menu

7-1 INTRODUCTION

Snooper is able to perform several different types of RAM test. All of the RAM tests perform the same basic function. They save the contents of an area of RAM and put something else in that area of RAM. They then read the RAM contents to make sure that it is the same data that was placed there, and then replace the original contents of that area. The only variation between the three types of tests provided is the "test pattern" of data that is written to the area of RAM.

We have provided three types of test patterns for completeness even though it is not likely that the RAM would survive one test pattern and fail the others. The three patterns are the 'User Selected Pattern', 'Walking 0's' and 'Walking 1's.' Most users will find any one of the tests to be sufficient for their needs.

The last RAM test is specifically for Parameter RAM (PRAM) (see glossary), a separate section of non-volatile RAM which cannot be tested by the other tests in the Memory menu.

There are two primary failure modes for memory. One type is a failure of the actual 'chip' (the delicate 'chip' of silicon that performs the memory function), and the other is a mechanical failure of the connections between that piece of silicon and the rest of the computer.

Connection Failure

Some of those connections are inside the little plastic package that surrounds the 'chip'. These are tiny little wires called 'wire bonds' that are literally welded to a little patch of metal deposited on the surface of the silicon (you would need a strong magnifying glass or microscope to see the weld) at one end and soldered to the pin that comes out of the plastic package at the other end. These little 'wire bond' wires are thinner than a human hair and very delicate. The stress placed on these tiny wires by expansion and contraction as the computer warms up and cools down can cause them to break. When they break they usually break the connection completely, and the Macintosh will "blow chimes" (see glossary) at startup. Sometimes, however, a wire bond will break but not separate. When the machine warms up, the two ends come apart and an error occurs. When it cools back down, the two ends go back together and everything appears to be fine, so the machine starts up normally and passes the startup RAM test. Snooper is very good at finding this type of RAM problem with its cycling RAM tests.

Another type of mechanical intermittency with RAM occurs outside the plastic package on the small circuit board called a SIMM (see glossary). The many tiny pins on the plastic package are soldered to 'traces' (see glossary) on the SIMM. When the computer warms up, the SIMM board can warp or twist very slightly. When this happens a weak or broken

solder joint can separate just far enough to break the connection. This is often such a small gap that it cannot be seen with the naked eye (or even a scantily clad eye). This is another example of an intermittent RAM problem that would not be caught by the startup RAM test performed by the Macintosh but would be caught by the cyclic testing done by Snooper.

Yet another way this can happen is if there is a small fracture in one of the traces on the SIMM board which is a situation very similar to a broken wire bond. Tiny amounts of warping and twisting occurring as the Macintosh warms up can cause one of these fractures to "open up" and lose the connection between the chip and the computer. The last of the mechanical failures which can sometimes create an intermittent situation is bad contact between the SIMM module and the connector that it plugs into. While this type of mechanical failure is usually not intermittent, the warping and twisting mentioned above can sometimes cause it to be intermittent in nature.

Chip Failure

The other type of RAM failure, when the silicon chip itself fails to operate correctly, is really much less common than the connection problems mentioned above, but it does happen. Sometimes a poorly manufactured chip can have contaminants on it that can cause a failure after many hours of operation. The contaminants act together with the heat generated by the chip and the electronic forces present to change the physical structure of a small area of the chip near the contaminant. This can cause one or more bits within the memory chip to stop working altogether, or to become "weakened" to a point where they just barely work if everything is just right. If one or more bits stops working completely, the Macintosh will catch it during its next startup check of the RAM and "blow chimes". If the chip is just made marginal by this corruption, a failure can be brought about by temperature or momentary dips in the supply voltage, or the importance of the task being performed on the computer. This type of failure is easily found by Snooper.

Note: Because Snooper would fail and crash the computer if it were to write test data into the part of the program that is performing the test, the section of RAM that Snooper resides in is skipped over in all of the RAM tests. Normally this is not a large enough section of RAM to prevent the detection of bad RAM, but in order to be absolutely certain you have tested all of RAM, you can simply test RAM with only the Snooper application running, and then quit Snooper and launch some other program first before loading Snooper again. Running Snooper with another application launched first will cause a different part of RAM to be skipped (because Snooper is now loaded into a different spot in RAM).

Note: None of the RAM tests are available if the Apple RAM Disk (available in the Memory Control Panel on some machines) is enabled. PRAM test is still available.

7-2 MEMORY MENU: WALKING 1'S

The Walking 1's test uses a pattern which consists only of zeros except for a single 'one'. The 'one' value is moved to a different bit within the data at each address with each pass through RAM.

The reason this type of memory testing is regarded as superior to using an unchanging pattern to test the RAM is that there is a certain type of failure that it can catch that an unchanging pattern might miss. This is a failure of the chip itself, not the various connections between the chip and the computer. One type of "weakening" of a bit in the chip can cause it to perform differently depending on the data stored in the bit right next to it on the silicon. This type of "crosstalk" between bits on a RAM chip can go undetected if an unchanging pattern is used to test memory if that pattern doesn't happen to include the combination on the adjacent bits that doesn't work because of the "crosstalk". With a changing pattern such as the walking ones test provided by Snooper, this and all other failure modes are detected.

When an error occurs, the window will display the malfunctioning memory address and display a pattern that can be used to find even which bit of the data at that address was different from the test pattern. The address provided can be used with **Table 1** to find the faulty memory SIMM.

7-3 MEMORY MENU: WALKING 0'S

The Walking 0's test uses a pattern which consists only of 'ones' except for a single zero. The 'zero' value is moved to a different bit within the data at each address with each pass through RAM. The position of the Walking 0 is shown beneath the 'Pass number' in the test window.

When an error occurs, the window will display the malfunctioning memory address and display a pattern that can be used to find even which bit of the data at that address was different from the test pattern. The address provided can be used with **Table 1** to find the faulty memory SIMM.

7-4 MEMORY MENU: PATTERN

The Pattern test offers you 16 pattern selections from a pop-up menu. These patterns are used in the much the same way as the Walking 1's and 0's. The only difference is that you choose the pattern which Snooper will use in its test.

When an error occurs, the window will display the malfunctioning memory address and display a pattern that can be used to find even which bit of the data at that address was different from the test pattern. The address provided can be used with **Table 1** to find the faulty memory SIMM.

7-5 MEMORY MENU: PARAMETER RAM

The last memory test available in the Memory menu performs a cyclic test on the "non-volatile" RAM that remembers system settings such as mouse speed and serial port configuration. It also tests the nonvolatile RAM that remembers NuBus configurations. The parameter RAM is the RAM that is kept "alive" by the same battery that keeps the clock running when the computer is off. In fact, some of the PRAM is actually in the clock chip.

Since the PRAM is not on a SIMM and cannot be replaced, a failure in this test simply causes a message to be displayed warning you that an error occurred. A failure in the PRAM can only be fixed by swapping out the motherboard. This would normally be done by an Apple Authorized technician.

Table 1. RAM address chart.

How to use this table:

The numerous SIMM configurations possible in the Mac family are broken down in this table. To locate the problem SIMM, first select the part of the table that refers to the correct type of machine (i.e. Mac Classic, Quadra 700, etc.) Then further narrow it down by the total amount of RAM installed in the machine. That section of the table will tell you how to use the address and the symbolic representation of the data failure at that address to locate the bad SIMM. The address is a number that the computer uses to refer to a specific area in memory where something can be stored; much like your street address. The RAM test uses these numbers to refer to an area that holds 32 "bits", or 32 little circuits that can store the tiniest possible piece of information. You can think of a bit as a Yes/No, or an On/Off. Eight of these bits are called a byte, and that is the way they are organized on the SIMM. The display given when RAM fails shows the address where RAM failed, and a row of X's and 0's. The X's are bits that failed, and the 0's are bits that were OK.

example:

Last Bad Address: 12345

00000000	00000000	00000000	00000X00
44444444	33333333	22222222	11111111

In this example there is a failure of one bit in the first SIMM (or the first byte) at the address 12345. If you were to look through the table you would find that this example would be SIMM 1 of bank A on any Macintosh (or soldered to the motherboard on machines that have some soldered in RAM).

MAC 128K, MAC 512K, MAC PLUS, MAC SE, CLASSIC, CLASSIC II, OR POWERBOOK 100:

With 1 Meg total RAM:

These machines address RAM in 2 byte chunks instead of 4 byte chunks. If one or more of the X symbols fall in the 1 or 3 area, it indicates a problem with SIMM 1 in bank A or B. If one or more X symbols fall in the 2 or 4 area, it indicates a problem with SIMM 2 in either bank. If the address given in the window is less than 524288, it is bank A otherwise, it is bank B. Classic , Classic II or PowerBook 100, it is soldered to motherboard regardless of address.

With 2 Meg or more of total RAM:

SIMM 1 or 2 selection is the same as with 1 Meg above. If the address given in the window is less than 1048576, the bad SIMM is in bank A. Otherwise, it is in bank B. Classic, Classic II, or PowerBook 100 if its less than 1048576, its on the motherboard, otherwise its SIMM 1 (X's in 1 or 3) or SIMM 2 (X's in 2 or 4).

MACII, MACIICX, MACIIX, MACIIFX, OR MACSE/30:

These machines all address RAM in 4 byte chunks, so the number below each 0 or X refers to the SIMM it is on in either bank A or B. Figure out which bank it is in with the following choices based on the total amount of RAM installed.

With 1 Meg total:

If the address given in the window is less than 524288, the bad SIMM is in bank A, otherwise it is in bank B.

With 4 Meg total:

You can only get this total amount of RAM with Bank A filled with 1 Meg SIMMs, so the bad SIMM is in Bank A.

With 5 Meg total:

If the address given is less than 4194304, the bad SIMM is in Bank A, otherwise Bank B.

With 8 Meg total:

If the address given is less than 4194304, the bad SIMM is in Bank A, otherwise Bank B.

With 16 Meg or more total:

If the address given is less than 16777216, the bad SIMM is in Bank A, otherwise it is in Bank B.

MACIIci:

This machine does not require that the largest SIMMs installed be in Bank A like the other machines do. If the largest SIMMs installed are in Bank A, use the part of the table for MacII, MacIIcx, etc. If the SIMMs are all the same size, or you only have 4 SIMMs installed, use that section also. If you have smaller SIMMs in Bank A that you do in Bank B, and you have 5 Meg total, and the address displayed in the window was less than 1048576 its in Bank A, Bank B otherwise. If you have 20 Meg total, and it was less than 4194304, its in Bank A, Bank B otherwise.

MACIIsi, OR MACIILC:

These machines have 1 Meg soldered to the motherboard and one Bank available for SIMMs. If the address is less than 1048576, the bad RAM is on the motherboard, otherwise its on the SIMM with the number shown below the one or more Xs in the window.

POWERBOOK 140, 170:

These machines have 2 Meg soldered onto the motherboard. Anything above address 2097152 is on the single RAM expansion board. Below that address its on the motherboard.

QUADRA 700:

These machines have 4 Meg soldered onto the motherboard. Anything above address 4194304 is on the SIMM indicated below the X in the window. Below that address its on the motherboard.

QUADRA 900:

These machines have 4 Banks of SIMMs each of which can hold 1 Meg SIMMs, 4 Meg SIMMs, or 16 Meg SIMMs. This is simple, but requires a little calculation. Start with Bank A and add the number below for the type of RAM in each Bank until the total is greater than the address shown in the window. The last bank you added is the culprit.

1 Meg SIMMs: 4194304   4 Meg SIMMs: 16777216   16 Meg SIMMs: 67108864

MACHINES LATER THAN QUADRA 900:

Use the Quadra 900 method. If there is motherboard RAM, treat it as the first bank.

The Video Menu

8-1 INTRODUCTION

This chapter describes the use of the "Video" menu to check the accuracy and alignment of the video circuitry and monitor connected to the Macintosh. All of the choices available in this menu are shown in **Figure 12** and are described separately in the sections that follow. The first six menu choices are applicable to any type of video monitor, be it a built-in, 9" black and white screen, a 24 bit large screen monitor, or anything in between. The remaining menu choices are only applicable - and only available - on systems that have a "main monitor" that is either color or gray scale, and set at 4 bits per pixel (16 colors or gray shades) or more in depth. The main monitor is the monitor which displays the menu bar. Both of these settings are handled in the Monitors Control Panel.

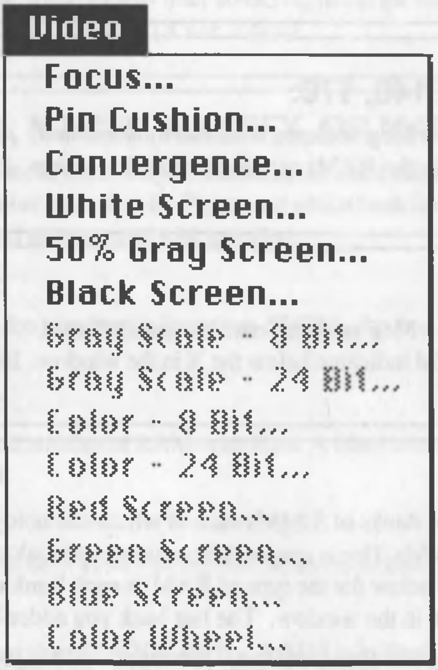

Figure 12. Video menu.

HANDLING MULTIPLE MONITORS

On a system that has more than one monitor connected, the other monitors can be tested by changing the selection of the main monitor. The system software of your computer includes a Control Panel which allows you to designate another available monitor as the main monitor. To change the monitor on which Snooper displays its video screens do the following:

- Select the 'Control Panel' under the "" menu.
- Click on the 'Monitors' icon (if you are running System 6.0.x) or double-click on the 'Monitors' file (if you are running System 7 or later). The "Monitors' setting window will appear (**Figure 13**).
- Click on and drag the menu bar to the desired monitor icon. **Figure 13** shows a single monitor configuration. Multiple monitors icons will appear in the window if your Macintosh configuration uses two or more monitors. The monitor icon sizes will be proportional to their physical size. To identify what monitor you have selected in this window, click on the 'Identify' button at the bottom of the window.
- Restart the Macintosh.

When Snooper is started again, it will use the newly selected main monitor for its Video screens.

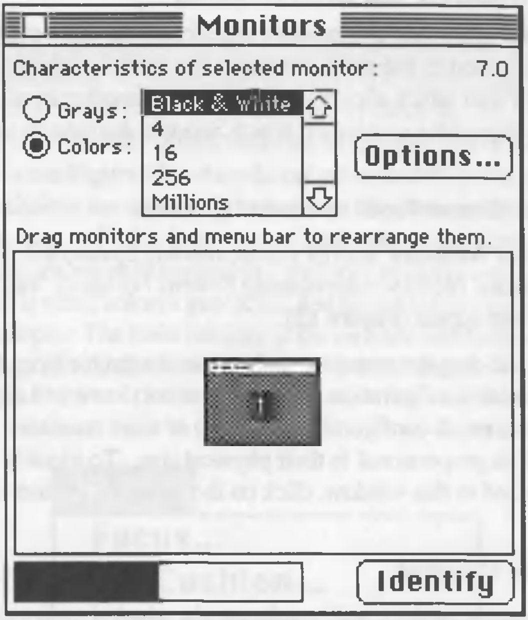

Figure 13. The Monitors Control Panel device.

Setting Number of Colors/Gray Shades

To set the number of colors or number of grays you want shown on your monitor, you click on the number in the upper portion of the Monitors Control Panel window. The Black and White selection is the same as "1-bit" pixel depth. The 4, 16, 256, and millions selections are the same as 2-bit, 4-bit, 8-bit, and 24-bit pixel depth respectively. Some video configurations available for Macintosh computers allow fewer choices or no choice in the pixel depth of the screen.

Table 1. Monitors Control Panel Options.

Stopping the Video Test

To open any of the test windows, choose a test from the "Video" menu, and the entire screen area (except the menu bar) of the Main Screen will be filled with the selected test window. To close any of the test windows, click the mouse button anywhere within the test window area (anywhere other than the menu bar). It is not required that you close one test window before opening another, but leaving several of the windows open at a time can cause screen clutter and use memory that might be needed for other purposes.

8-2 VIDEO MENU: FOCUS TEST

This menu choice will display a test screen that consists of a black screen with a white rectangle near the edges of the monitor and a “cross hair” area in the center. The focus of the monitor should be adjusted so as to obtain the best compromise between the focus at the corners of the rectangle and the dot at the center of the screen. Many monitors have an adjustment screw for focus on the back or along the lower front edge of the case. This is not a difficult adjustment to make, and a user should not be afraid to try it if the adjustment screw or knob is readily accessible.

8-3 VIDEO MENU: PINCUSHION

This test window is designed to uncover a problem known as either barrel distortion or pincushion distortion. This problem gets its name from the fact that lines are bent in a fashion similar in appearance to a pincushion or whiskey barrel. They can also be bent in the opposite direction, in which case they do not resemble either a pincushion or a barrel, but the same name is usually used for the condition.

The Pincushion command will display the test window shown in **Figure 14** that makes this type of distortion very noticeable on the screen. It is comprised of a black screen with several concentric white rectangles. All of the lines on the screen of a properly adjusted monitor will be perfectly straight. These lines should not bow in or out either along the top and bottom or along the sides. If you notice a significant bow, it can be an alignment problem, or, in some cases, a faulty monitor power supply. There is often no user adjustment for this condition, and it should be referred to a qualified technician for repair.

Figure 14. Pincushion Test window.

Magnetic Field Disturbances

There is another type of distortion similar to the pincushion distortion. This is a bending of the lines only in one area of the screen, with no corresponding bending in the opposite direction on the opposite portion of the screen. This type of bending is often caused by strong magnetic fields in the area surrounding the monitor. These fields can be caused by speaker magnets, electric transformers, other monitors, or just about any electronic or magnetic device. Occasionally there is a large deposit of iron ore in the area that can create local disturbances in the Earth's magnetic field.

Most of these magnetic disturbances can be solved by moving various parts of the system around until the problem goes away. If the problem is actually in the monitor itself, it can often be solved by a technician who can adjust the alignment magnets attached to the back of the picture tube in most monitors.

8-4 VIDEO MENU: CONVERGENCE

The convergence menu choice displays a screen that can be used to check, and if necessary adjust, the convergence of a color monitor. While this is usually only relevant to systems with a color monitor, it is made available for all displays since it can also be used to check for other types of image distortion, and may still prove useful on black and white monitors.

Adjusting the Monitor's Convergence

A few monitors have front panel control knobs for making this adjustment. A few others have "screw" type adjustments for it on the back or side of the monitor. If the controls are present, they are often called "V-Stat" and "H-Stat". Other monitors require removal of the monitor's case, which exposes the technician to potentially lethal electrical charges. Correcting the convergence of a monitor vastly improves the color quality of the display.

After you make the "Convergence" choice from the menu, the monitor shows a black screen with a single white rectangle near the edges of the monitor will be displayed. This is shown in **Figure 15**. Convergence is correct when the lines of the rectangle are pure white and do not show any fringes of color.

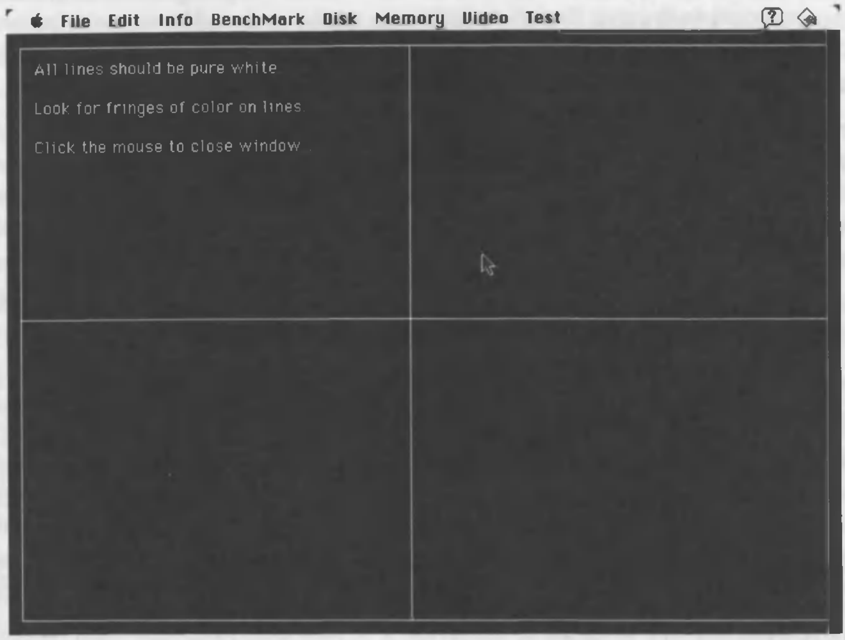

Figure 15. Convergence test screen.

Like other monitor adjustments, this often involves a compromise, especially on a large monitor (19" and larger). While it is usually possible to adjust the convergence to absolute perfection in one area of the screen, often it will be found to be badly out of convergence in another area of the screen at the same time. The monitor should be adjusted to provide the best compromise of convergence across the entire screen.

8-5 VIDEO MENU: WHITE SCREEN & BLACK SCREEN

These test windows, while very simple, can provide a number of useful tests on a monochrome or color monitor and the associated video circuitry. The primary reason for including them is to check for "dead pixels", or "stuck pixels." These conditions can be the result of either a faulty monitor or faulty display circuitry (the video card or internal video circuitry that creates the signal that drives the monitor).

A dead pixel is one that is always black regardless of the intended color or brightness of the pixel. The test for this condition is quite simple: Open the White Screen test window and look for any dark pixels anywhere below the menu bar. It is actually quite common

to find one or two dead pixels on a color screen due to manufacturing flaws in the "mask." The mask directs the three electron beams to the correct color of phosphor dot on the inside of the monitor's front glass. It is also possible for this to be caused by an imperfection in the phosphor in a small area of the screen. When dead pixels are found on a monochrome screen, this phosphor irregularity is usually the cause of it.

While these two manufacturing flaws are the most common cause of dead pixels, it is also possible for a faulty video card or built in video circuitry to cause dead pixels. If one or more bits in the video RAM are stuck "off", the corresponding pixels on the screen will be dark. There are two ways to tell for sure if the dead pixels are caused by the monitor or the display circuitry.

The simplest way is to swap either the monitor or the video interface card (display circuitry) and see if the pixels come to life.

The other way would be to temporarily shift the image on the face of the monitor using the horizontal or vertical positioning adjustment screws on the back of your monitor.

If the dead pixel doesn't move along with the rest of the display, then the problem is in the mask or phosphor of the monitor, and cannot be fixed. If, however, the dead pixel moves around on the screen when the positioning screws are changed, the problem is in the video circuitry of the computer (either the internal video or a video card, whichever is driving the monitor).

On a color monitor, all of the above would apply equally to any pixels or small areas that are neither white nor black, but some other color. Imperfections in the phosphor or mask of a color monitor can cause small areas to have only dead "green," "red," or "blue" dots without affecting the other colors. This can also be caused by faulty drive circuitry, so this 'swap and position' method can be used to determine whether the problem is in the monitor or the video circuitry.

Stuck Pixels

The other problem is called "stuck pixels." This is a condition where pixels that are supposed to be dark are white or some other color instead. The "Black Screen" test window can be used to quickly find any stuck pixels on a monitor. Unlike dead pixels, stuck pixels are caused primarily by the video circuitry rather than the monitor. The most common cause is a bad bit(s) in the video RAM of the video card or display circuitry.

8-6 VIDEO MENU: 50% GRAY SCREEN

The 50% gray screen test window is provided primarily to detect imperfections in the sawtooth raster signals that cause the electron beams within the monitor to move back and forth and up and down. Many people don't realize it, but only one pixel of the screen is actually "lit up" by this electron beam at a time. The appearance of a full screen image is

caused by the persistence of your eyes and the persistence of the phosphor on the screen. If the signals that move the beam around on the screen have a glitch, it will show up on this screen as a white or black line (either horizontal or vertical) across the whole screen. The line is caused by an interruption in the otherwise consistent pattern of dots on the screen. A larger imperfection in the raster signals will produce an area of light or dark gray in the effected area of the screen, as the dots are closer or further apart.

One particularly interesting facet of this test screen is that a 50% gray pattern produces a continuous output from the video card at its maximum frequency. This could be used to determine whether or not a particular monochrome monitor really has adequate frequency response to give crisp, clear images. With the 50% gray screen displayed, a monochrome monitor should show every other dot totally on or totally off.

You can look with a magnifying glass to see if the dots of light and dark are clearly defined, or if they tend to just vary within a narrow range of medium brightness. A monitor with sufficient video bandwidth will show precise dots of black and white rather than gray dots. This high frequency screen might also be useful when looking for radio interference caused by the video circuitry, as radio emission from electronic components tends to get worse as the frequency goes up.

8-7 VIDEO MENU: GRAY SCALE - 8 BIT AND GRAY SCALE - 24 BIT

You can only perform these tests if your Macintosh is set to 16 or more grays or colors in the Monitors Control Panel. Consequently, if your system does not support these settings, the tests will not be available to you. If set to 16, it should be grays for this test.

These test windows can be used to test for proper calibration and setup of gray scale monitors. With the test window displayed, the brightness and contrast should be adjusted so as to achieve the whitest white possible while the darkest bar on the left side of the window is completely black. Monitors that have a gamma adjustment inside the monitor case that can be adjusted to give an even gradation of gray across the screen. Do *not* attempt this adjustment unless you are a technician trained to perform monitor repairs.

If you have a 4- or 8-bit per pixel system, and you select the 24 bit Gray Scale test window, the computer will approximate the correct display as well as it can by “dithering” the available gray scale levels to emulate the 24 bit gray scale levels. This will, by the way, take some time, and the screen will be painted slowly. When using a color monitor with these test windows it is recommended that you use the “Monitors” Control Panel to set the video mode to “gray scale.” This will give you the best display with these test windows. This is not necessary if the display is set to "millions".

8-8 COLOR 8 BIT, COLOR 24 BIT, & COLOR WHEEL

These tests will be selectable if you have set your Monitors Control Panel device to 4 bit (16 colors), 8 bit (256 colors), or 24 bit (millions of colors) color levels.

These tests are provided for checking the color quality of the display system, and for additional calibration and setup screens. There is no specific shortcoming you should look for here. The intent is just to give you a standard screen that can be compared between different systems, and any major changes noted.

As with any window that shows deeper color than the screen is currently set for, if these screens are used with fewer bits of color than they were designed for, the Macintosh will try to compensate by "dithering" the image to give an approximation of the way it would appear on a screen set for the correct number of pixels. This will sometimes yield an unacceptable screen image, especially with 16 colors.

8-9 RED SCREEN

This test will be selectable if you have set your Monitors Control Panel device to 4 bit (16 colors), 8 bit (256 colors), or 24 bit (millions of colors) color levels.

This test window is provided primarily to test the red channel of the video circuitry and monitor. Use it to look for an uneven coloration across the screen or from top to bottom with this test window. On an 8 bit video system, the color provided by this test window is the closest color there is to “absolute red”, in other words as close as the system color table comes to putting out maximum intensity on the red gun and zero intensity on the blue and green guns. On a 24 bit system, it should be exactly maximum red and zero green and blue. If there is a major difference in brightness between this screen and the green or blue screen, it might be a monitor problem, a weak video amplifier on the video card, or a bad video cable.

8-10 GREEN SCREEN

This test will be selectable if you have set your Monitors Control Panel device to 4 bit (16 colors), 8 bit (256 colors), or 24 bit (millions of colors) color levels.

The purpose of this test is the same as the red screen above, except it checks the green channel of the video system. You might notice that the color most of us associate with green is more of a forest green. The color this window puts on the screen is a very unattractive yellow-green color, but is nevertheless the actual color of the green phosphor used in making color monitors. As with the red screen above, an 8 bit system shows this color as the closest match to perfect green that exists in the system color table. A 24 bit system shows it as “exactly green.”

8-11 BLUE SCREEN

This test will be selectable if you have set your Monitors Control Panel device to 4 bit (16 colors), 8 bit (256 colors), or 24 bit (millions of colors) color levels .

This test window is a nice change of pace from the ugly green screen. An 8 bit system shows this shade of blue as the closest match to perfect blue that exists in the system color table. A 24 bit system shows it as "exactly blue."

The Test Menu

9-1 INTRODUCTION

This chapter describes the functions grouped together under the "Test" menu, which is shown **Figure 16**. These functions include tests for components that don't quite fit under any other test menu in Snooper.

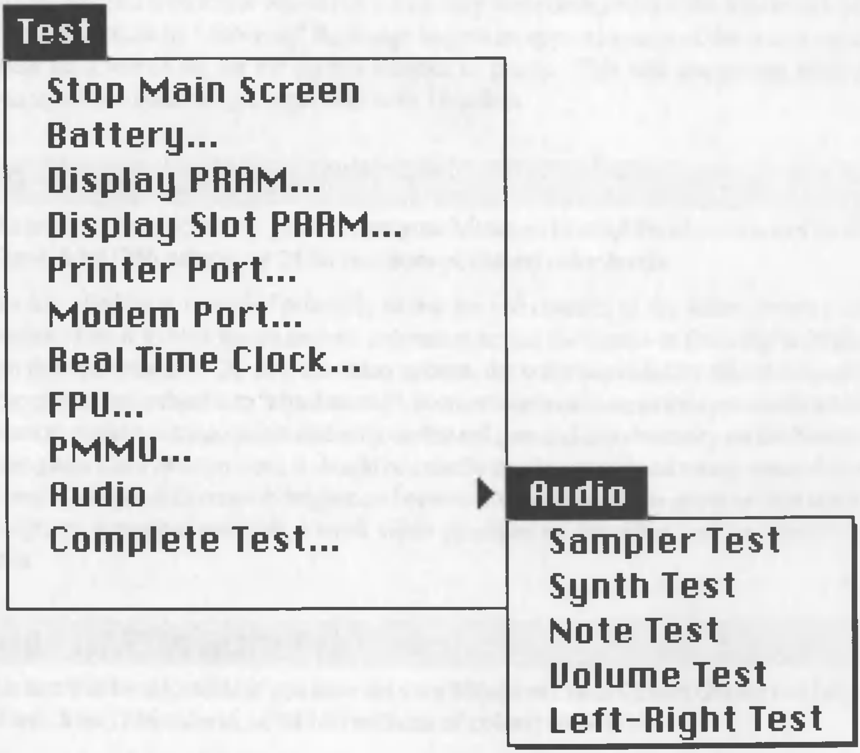

Figure 16. The "Test" menu.

9-2 TEST MENU: BATTERY

This test checks to see if the data stored in the clock chip has been lost. There is no way to make a direct measurement of the Macintosh backup battery from software, so this test is the only method to accomplish the task. The test result is shown in the Battery Test window, shown in **Figure 17**.

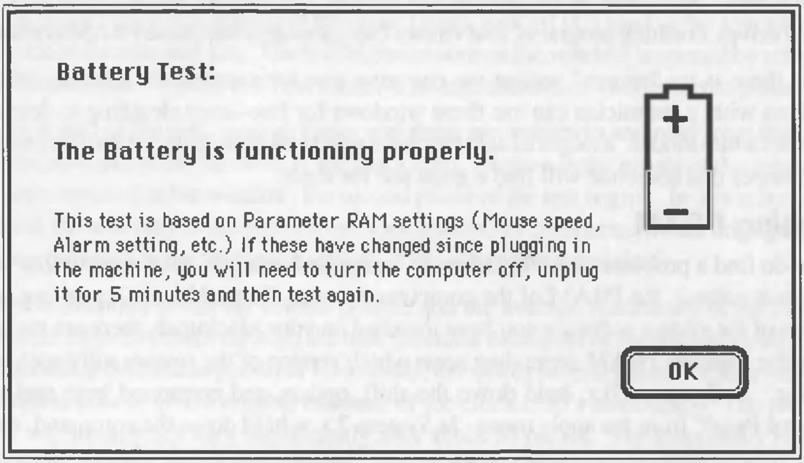

Figure 17. Battery Test Window.

The first time this window is opened, the test does its best to determine whether or not the data in PRAM (see glossary) seems to be consistent with proper battery operation. To make certain that all is well with the battery, the test also stores data into unimportant parts of PRAM, which can be used on a subsequent check to see if the data survived a shut down. A complete test of the battery consists of the following steps: Open the Battery Test window (this will store data into unused portions of PRAM), shut down the computer and unplug it from the AC line for 10 minutes or more, plug the machine back in and start up Snooper. Re-check the Battery Test window. If, after these steps, the Battery Test window shows the battery to be good, all is well with the battery.

Why Unplug the Mac?

The computer needs to be unplugged for some time to ensure the results of the test because some models of Macintosh provide a trickle of power from the supply to power the clock and PRAM even while the computer is off. With the computer unplugged for a little while, you can be sure that the clock and PRAM are actually running off of the small battery on the motherboard.

9-3 TEST MENU: DISPLAY PRAM AND DISPLAY SLOT PRAM

These two menu choices allow you to view the contents of either the standard PRAM or the NuBus Slot PRAM. Occasionally, although not too often, SCSI or NuBus devices can prevent the Mac from booting from a hard drive when the PRAM contents become scrambled. This is because information vital to the proper function of these devices is stored in standard PRAM and the NuBus Slot PRAM. Low battery power, damaged boards or hard drives, crashing programs, and viruses (see glossary) can cause PRAM corruption.

While there is no "proper" setting we can give you to compare the contents of these windows with, a technician can use these windows for free-lance sleuthing to determine possible failure modes. It might be said that these windows were included for completeness in the hopes that someone will find a good use for them.

Zapping PRAM

If you do find a problem with PRAM using these windows, you may want to 'zap' (clear to default values) the PRAM of the computer to solve the problem. Depending on the version of the system software you have installed on your Macintosh, there are two ways to zap the standard PRAM depending upon which version of the system software you are running. In System 6.0.x, hold down the shift, option, and command keys and select "Control Panel" from the apple menu. In System 7.x.x, hold down the command, option, P, and R keys while the machine is booting up. You can clear the slot PRAM for a single slot by starting up the machine with the board that was in that slot removed. Then turn the machine back off and re-install the board. When the machine is started again, the card may store default values in the PRAM, or leave it blank until you change the settings for the card using a control panel device included with the card.

9-4 TEST MENU: PRINTER PORT

This test performs a more robust version of the Main Screen Printer port test. As with the Main Screen version of the Printer Port Test, this test requires the installation of a serial loopback plug in the printer port and you need to disable any other printer port software that may be using the port (see **2-3** for more setup information).

The test is comprised of two facets. The first part tests the hardware handshaking lines of the port, and the second part tests the data lines of the port at 300, 1200, 3600, and 9600 baud (the test in the main screen only tests the port at 2400 baud). There is an audible beep anytime a test fails. This enables a technician to start the test and go on with other work without keeping his eyes glued to the screen.

9-5 TEST MENU: MODEM PORT

This test and the Printer Port Test (**9-4**) are virtually the same. The only difference is which port is tested. The loopback plug and port software admonitions given in that section apply equally to the Modem Port Test.

9-6 TEST MENU: REAL TIME CLOCK

This test allows for cyclic testing of the Real Time Clock (RTC) used in the Macintosh to keep track of the time and date. The test begins as soon as the window is opened by selecting "Real Time Clock..." from the Test menu. The test consists of two different phases.

In the first part of the test, random times and dates are written to and read from the clock to test the read and write functions of the clock chip. As soon as the results of this test phase have been reported in the window, the second phase of the test begins. In this second part of the test, the accuracy of the Real Time Clock is tested by comparing it with timing signals based on the more accurate timing crystal of the microprocessor clock.

The test is intended to run for several passes, and the average inaccuracy of the clock is noted after 10 to 20 passes through the test. Because each pass of the test only checks the clock accuracy over a time period of 10 seconds, it requires several passes for the averaging of the test results to give a reliable estimate of the clock chip's inaccuracy. The result of the test will usually not vary significantly after about 30 passes. The inaccuracy is given both in parts per million and as a number of minutes the clock would gain or lose over a period of one year.

Real Time Clock Results

The crystal used for the RTC is not particularly good, and inaccuracies in the range of ± 10 to 20 minutes per year are common. Some are off as much as 30 minutes a year without being considered "broken." If your RTC is within ±5 minutes per year, consider yourself blessed. Another point to keep in mind is that although the Real Time Clock is crystal controlled, there is still some variation of its accuracy with temperature. A Macintosh that is kept in a room that is allowed to get cold at night might easily give better or worse results than this test would suggest. All disclaimers aside, it is fun to see how far off your clock is. Many people seem to get attached to this test screen, always waiting just a few more passes to see if it gets a little better... or a little worse, then just a few more passes....

9-7 TEST MENU: FPU (FLOATING POINT UNIT)

The Floating Point Unit test is only available (can only be selected from the menu) if the machine has a math co-processor installed. This test is similar to the math benchmark except that in this test, the score is based on the accuracy of the answers to the test rather

than how quickly they are performed. The test gives the floating point unit a very grueling quiz and the answer is supposed to be 42. If the FPU comes back with any other answer to the ultimate question of life, happiness, and everything, it flunks the quiz, and the error is tallied in the test window. See the chapter called "Technical Details For the Terminally Curious" for a detailed explanation.

9-8 TEST MENU: PMMU

This test is only available on those machines which have a PMMU (Paged Memory Management Unit) either as a separate chip or as part of the microprocessor. The Motorola 68030 and 68040 microprocessor chips contain an integrated PMMU. Old Macintosh II models with the 68020 microprocessor have a PMMU chip socket on the motherboard. A PMMU chip can be installed in these systems.

In addition, the test requires the activation of the system's virtual memory feature (see section 2-5).

This test window performs a cyclic test on the PMMU by having it do what it does best, convert logical RAM addresses (see glossary) into physical (actual RAM) addresses. It does this by calling the memory management ROM routine called "GetPhysical" repeatedly. For some reason the Apple engineers avoided their usual sense of humor and failed to call this routine "LetsGetPhysical".

9-9 TEST MENU: AUDIO TESTS SUBMENU

From the beginning, the Macintosh has had a very good audio system for a personal computer. All of the Macintosh computers include three basic types of audio circuitry, each of which serves a useful function within the computer. These are the "Sampled Sound Generator," "Wave Synthesis," and "Note Synthesizer." Other aspects of the audio system which can be tested are the volume and stereo attributes.

Sampled Sound Generator

The first type of audio, and by far the most versatile is the Sampled Sound Generator. With this audio system, developers can add digitized sounds such as speech or musical instruments to applications. While it is the most versatile sound system on the Macintosh, it also takes a fair amount of CPU time. In fact, some of the early Macintosh models such as the Mac 128K and 512K were barely able to support this feature. Those slow machines can produce sampled sounds, but can't do anything else at the same time.

How Sampled Sound is Produced

Sampled sound is produced by recording the amplitude (how loud it is) of a sound several thousand times per second, and then using that information to drive the speaker. You can think of it as recording the position of the speaker cone thousands of times per second. The

playback consists of the computer looking at the recorded cone positions and telling the speaker, "...go to here, now go to here, now go to here...." It is actually a very simple system, but it happens so many times per second that it takes a great deal of the computer's time.

Testing the Sampled Sound Generator

To test the part of the Macintosh sound circuitry that produces sampled sound, the first menu choice under the Audio submenu has been provided. This menu choice plays back a sampled sound of someone saying, "The audio is functioning correctly." This may be falsely optimistic in situations where it is not quite functioning correctly. There is no way for the machine to determine whether or not the sound is being correctly produced by the speaker. It is up to the user to listen to the sound produced and determine if there is a problem. On a properly functioning machine the sound will be clear and undistorted.

Wave Synthesizer

The second type of audio produced by Macintosh computers is called Wave Table Synthesis. This type of audio is related to the Sampled Sound Generator in that the data used is a list of amplitudes (or speaker cone positions). The difference is that with this type of sound, only 512 separate data points exist to tell the speaker where to go. When these 512 "samples" are used up, the sound generator goes back to the beginning and starts to use the same "samples" over again. This is fairly useless for the production of sound that varies over time like a human voice or the sound of a toilet flush, but it is quite usable in the creation of simple noises or the sound of some musical instruments.

The "samples" used with this portion of the sound generator are usually synthesized (that is, made up mathematically or by trial and error) rather than recorded with a microphone, and the list of amplitudes is called a "wave table"; hence the name Wave Table Synthesizer.

The advantage of this type of sound production is that it takes far less of the CPU's time to generate this audio. This is because most of the work is actually done by the "Apple Sound Chip" in those Macintoshes that have this chip. The CPU sends the data to the chip and says "GO." That is the end of the CPU's involvement until it is time to tell the sound chip to "STOP." As you can see, the CPU can be very busy doing other things while creating sound with the Wave Table Synthesizer.

Testing the Wave Table Synth

The second choice under the Audio submenu is provided to test this specific part of the Macintosh sound circuitry. If you select this menu choice, you should hear the standard Macintosh "beep" sound. If the sound is not there or is garbled, there is probably a problem with the Apple Sound Chip on the computer's motherboard.

Note Synthesizer

The third type of sound included in the Macintosh sound hardware is the simplest and least CPU intensive of the three. It is called the Note Synthesizer, and is equivalent to the sound

created by most IBM® and compatible computers. It is a square wave created by a signal which turns the speaker on and off at the proper frequency.

It creates a rather unimaginative sound, as you might expect. It is also the least expensive approach to create sound on a computer, and the one that uses the least CPU time. The CPU only has to send three small pieces of information to the Apple Sound Chip to make one of these beeps. It tells it the frequency (pitch), the volume, and how long to do it. This type of audio is considered to be beneath the Macintosh, and very few developers ever use it.

Testing the Note Synthesizer

To test this type of sound generation, select the third menu choice under the Audio submenu. You should hear a very boring 3 second long sound. If you like tests of the "Emergency Broadcast System" on the radio, you will find this test to be very enjoyable.

Volume Test

The fourth menu choice in the Audio submenu is used to test the volume of the audio system in a Macintosh. This uses the same continuous sound described above, but varies the volume of the sound from very low to very high volume.

This test will find problems that can sometimes occur when the sound is OK at low volume levels but becomes distorted at higher volume levels.

Causes of Volume Test Failure

The Apple Sound Chip can become damaged in such a way that it cannot handle the higher volume levels, but still performs well at low volume levels. If the sound becomes distorted as the volume increases, it could be either the sound chip, the small amplifier chip that boosts the sound going to the speaker, or the speaker itself. Often a torn speaker cone will sound just fine at low volume levels, but will start to distort as the volume is increased.

Left/Right Test

The next audio test called "Left/Right Test" makes use of the fact that most Macintosh computers are capable of putting out stereo sound. That is, play two separate audio channels at the same time. While most Macintosh models support stereo sound, none of them to date contain two speakers.

A few of the models currently available combine the sound from the two channels and send all of it to the single speaker. Many models, however, only send the Left audio channel to the internal speaker. In these systems, the right channel can only be heard when you use stereo speakers or headphones connected via the audio jack. This test uses the sampled sound generator to say "This is the Left side" through the left audio channel (heard through the internal speaker on all models) and "This is the Right side" through the right audio channel (available only through the audio jack on most models).

9-10 COMPLETE TEST

This window is similar to the Complete Info (in section **2-5**) window in that it can be printed or saved as a file and reviewed at a later date. Whenever this window is open and is the front-most window, a 'Print' or 'Save' selection from the "File" menu will, as you might expect, print or save the contents of this window. This window is provided specifically for the functions of printing and saving the results of the tests available in the Snooper software. The test results that are displayed in this window include all of the tests in the Main Screen, all of the benchmarks under the Benchmark menu (Chapter **3**), and some of the tests in the Test menu.

The tests that make up this window take some time to perform, so the window takes the information from the Main Screen rather than performing its own tests. For this reason, the Complete Test menu choice is not available to the user until the Main Screen has completed the first round of tests. In other words, each of the Main Screen tests has to be performed at least once before the Complete Test menu choice is activated and made available to the user.

As with the other saveable window in Snooper, the file created by saving this window can be opened by Snooper using the 'Open' menu item in the File menu. The file is a 'TEXT' file, so you can also open it using a text editor or word processor, or import it into a spreadsheet or data base program for logging the results for a large number of machines.

Technical Details For the Terminally Curious

10-1 INTRODUCTION

This chapter contains information that is not needed to use the Snooper diagnostic software. It is included only for those readers who have a thirst for knowledge and for those who are bored and don't have anything better to do. This chapter is solely provided to quell the infinite curiosity that is common among Macintosh enthusiasts. Unlike the rest of this manual, the emphasis in this chapter is on relief of "Curiosis Terminalis" rather than using the product.

10-2 ADB TESTS

The tests for keyboard and mouse look at the Apple Desktop Bus and find a keyboard and mouse (or a trackball). Once it finds them, it asks them to send the contents of their "register 3" which contains identification data and other good stuff. If Snooper receives a sensible reply to these requests, the keyboard and mouse are assumed to be OK. The fact that you were able to use them to start the Snooper software in the first place is also a good sign.

10-3 RAM TEST

The RAM test included in the Main Screen fills all of the available RAM (a little bit at a time) with a test pattern of alternating **1**'s and **0**'s. The test pattern is written and read back and the accuracy checked, and then the original contents are put back. It is necessary to disable interrupts while testing the RAM to avoid having interrupt driven activities trying to use the RAM that is being tested. This makes mouse movement rather nervous and jerky while the RAM test is underway.

10-4 SCSI TEST

The SCSI test checks each address on the bus. When it finds a SCSI device, it asks it for the secret password. Actually it just asks them to send their "Inquiry Data", which includes information that is stored in the hidden recesses of the device that gives the name of the device, who made it and some other details. If all of the devices found on the bus successfully give up this data to Snooper, the SCSI bus test passes with flying colors. If there are any errors during the process, the test fails.

10-5 FLOPPY TEST

The Floppy Test done in the Main Screen is almost identical to that done by the Floppy Test Window (available under the Misc. Menu of Snooper). The details of this part of the Main Screen test are given in the section of the manual that describes the Floppy test.

10-6 SERIAL PORT TEST

The only difference between the Modem and Printer Port Tests performed in the Main Screen and those performed in the specific test window, is that the two ports are only tested at 2400 baud in the Main Screen. The tests performed in the Modem and Printer Port Test windows are done at several different baud rates. See those sections of this manual for more details.

10-7 REAL TIME CLOCK TEST

The Real Time Clock test in the Main Screen times the clock for one second and fails if the accuracy of the one second interval is below an acceptable level. The intent of this test is primarily just to check and see if the clock is ticking. More grueling testing of the RTC is provided in the Test menu (Section 9-6).

10-8 CPU BENCHMARK TESTS AND FPU TEST

The following section shows details of the benchmark tests contents. As stated earlier, these tests are intended to compare Apples with Apples, and no effort has been made to relate them to Vax MIPS or any other alleged standard of performance. The following is a code snippet that shows what happens when the Math benchmark is grinding away (this same stuff is used to test the FPU):

```
for (count = 0; count < 30; count++)
    {
    Tom = Dick = Harry = 1.0;
    Fred = Barney = 2.0;
    Larry = Darryl = OBDarryl = 3.0;
    // lets do some long doubles first
    Tom = Dick * Harry/4.000 + (Pi/2.0) - log10(42.0) + log(42.0) + sqrt(42.0);
    Dick = Dick * Harry/4.000 + (Pi/2.0) - log10(Tom) + log(Tom) + sqrt(Tom);
    Harry = Dick * Harry/4.000 + (Pi/2.0) - log10(Dick) + log(Dick) + sqrt(Dick);
    Tom = Dick * Harry/4.000 + (Pi/2.0) - log10(Harry) + log(Harry) + sqrt(Harry);
    // now we will do some short doubles
```

```
// this calculates the distance from here to eternity
Fred = 1234567.89 * sqrt(Barney/Pi) + (cos(Pi/2.0) + sin(Pi/4.0) / pow(Fred,Barney));
Fred = 1234567.89 * sqrt(Barney/Pi) + (cos(Pi/2.0) + sin(Pi/4.0) / pow(Fred,Barney));
Fred = 1234567.89 * sqrt(Barney/Pi) + (cos(Pi/2.0) + sin(Pi/4.0) / pow(Fred,Barney));
Fred = 1234567.89 * sqrt(Barney/Pi) + (cos(Pi/2.0) + sin(Pi/4.0) / pow(Fred,Barney));
// now some floats that are stored as registers on machines that have registers for floats
// this calculates how many angels can dance on the head of a pin
// it assumes they are doing the Lombada
Larry = Darryl + OBDarryl - Larry * OBDarryl / Darryl;
Larry = Darryl + OBDarryl - Larry * OBDarryl / Darryl;
Larry = Darryl + OBDarryl - Larry * OBDarryl / Darryl;
Larry = Darryl + OBDarryl - Larry * OBDarryl / Darryl;
Larry = Darryl + OBDarryl - Larry * OBDarryl / Darryl;
Larry = Darryl + OBDarryl - Larry * OBDarryl / Darryl;
}
return (long)((float)(Tom + Dick - Harry * Larry / Darryl - OtherBrotherDarryl)/( -2.9762));
// -2.9762 is the Universal Flatulence Constant (UFC) as derived by the author
// the ultimate answer is of course 42
```

This doesn't calculate anything useful, but it does keep the microprocessor or floating point unit busy for a while. That's all it is supposed to do.

10-9 MEMORY BENCHMARK TEST

The Memory Benchmark moves some data around in two different ways that are typical of memory usage in Macintosh applications. First it moves about 33K of data around one byte at a time with a "for loop" construct. Then it moves about 330K of data around using the Macintosh ROM routine "BlockMove." While not very complicated, it is fairly representative of the way data is moved around in a Macintosh.

10-10 VIDEO BENCHMARK TEST

The Video Benchmark creates an off-screen bitmap (a fancy way of saying that it carves out a section of RAM and uses it as a make-believe screen), and then proceeds to create a simple drawing in it. The drawing consists of the following:

1) Fill in 10 rectangles that are 100 pixels by 100 pixels

2) Draw 40 lines

3) use the "CopyBits" routine to copy the 200 by 200 pixel bitmap onto itself 5 times.

All of the above is done 3 times to complete one pass of the benchmark.

10-11 COMBINATION BENCHMARK TEST

The Combination Benchmark is, just as its name implies, a combination of the other three benchmarks just as given above.

Well, we hope that if you found it necessary to read this chapter that the above information was helpful, and that your case of Curiosa Terminalis is now in remission.

Glossary

4 bit - When discussing video, pixel depth, or the number of gray shades or colors possible on a monitor, 4 bit is 16 (or 2^4) shades or 16 colors respectively. See gray scale or color for more information.

8 bit - When discussing video, pixel depth, or the number of gray shades or colors possible on a monitor, 8 bit is 256 (or 2^8) shades or 256 colors respectively. See gray scale or color for more information.

24 bit - When discussing video, pixel depth, or the number of gray shades or colors possible on a monitor, 24 bit is 16.7 million (or 2^{24}) shades or 16.7 million colors respectively. See gray scale or color for more information.

accelerator - An expansion product that can be added to a computer in order to speed its processing. It is generally a board with a fast CPU on it.

access time - see seek time.

ADB - see Apple Desktop Bus.

Apple Desktop Bus (ADB) - User input device bus built into every Macintosh model after the Mac Plus. These devices include the Mac mouse, keyboard, track balls, and light pens and some other miscellaneous devices that have nothing to do with inputting data from the user (like software keys used to prevent unauthorized users from using a program). The ADB supports up to 15 devices, but 2 or 3 is typical.

Apple Sound Chip - Processor designed specifically to control the functions of sound output in a Macintosh.

AppleTalk - Network communication protocol built into every Macintosh. This is software that works with either the serial port or an ethernet port to provide communication between several Macintosh computers.

barrel distortion - see pincushion.

black and white - When discussing video, pixel depth, or the number of gray shades or colors possible on a monitor, black and white (light and dark) are the only possible "colors" that can be displayed. See gray scale or color for more information.

Blow Chimes - The Macintosh computer performs a limited number of tests as part of its startup procedure to determine whether or not the machine is healthy enough to be used. If the computer fails any of these startup tests (such as the memory test) it makes a special sound. The sound is actually quite pleasant, but once you know what it means, it tends to send a cold shiver up your spine when you hear it. When the Mac makes this sound and displays a "Sad Mac" on the screen, it is said to have "Blown Chimes".

boot - This is another name for the procedures the computer goes through when you turn it on or Restart it. If a computer successfully completes this procedure, it is ready to run a program selected by the user. Conversely, a computer that doesn't complete this procedure displays a "Sad Mac" or other painful message.

bus - Any of the various connection schemes used to connect something to the motherboard of the computer. The ADB (Apple Desktop Bus), NuBus, and SCSI bus are three examples of a bus.

cache - An area where frequently accessed information is stored and can be accessed more quickly than from ordinary storage. There are two types of this in Macintosh computers. One of them exists on all Macs and involves data that is read in from either a floppy or a hard disk. The most recently read data is remembered by the cache so that if it is accessed again right away, the data is read quickly from the cache (i.e. from memory) rather than more slowly from the disk. The other type of cache is available with machines that use either the 68030 or 68040 processor chips. This involves data that is already in main memory rather than disk data. It is similar to the first type, but employs super fast memory (either in the processor itself or on a "cache card") to remember frequently used data. The 68040 does quite a bit of this and does it in a different way that greatly speeds up processing, but can cause compatibility problems with some types of software. This cache can be turned off on 68040 machines to maintain compatibility with those programs that aren't written to withstand this type of cacheing.

Chooser - Part of system software that offers users selections for peripherals such as printers, modems, and file servers. You can access these resources by selecting the Chooser in the Apple ( ) menu.

computer - If you don't know what a computer is, please put this book down and call a technician now.

Control Panel - Area collectively referred to when a need arises to adjust hardware settings for the Macintosh. These settings include monitor pixel depth, desired boot drive, internal clock/calendar, RAM cache, and sound volume. You can access these 'devices' by selecting the Control Panel in the Apple ( ) menu.

Control Panel device - The name given to the "mini programs" found in the Control Panel. They are used to control the operation of optional equipment and various System settings and parameters.

convergence - The degree to which the three electron beams from the monitor's gun agree on the exact location of any given pixel. In other words, how well or poorly the three beems are aligned to each other. Poor Convergence causes poor color and color fringing.

CPU - Acronym for Central Processing Unit. Executes instructions from information in

RAM and ROM. The Macintosh line of computers uses CPUs designed and manufactured by Motorola Inc. which all have names based on the number 68000; for example 68000, 68020, 68030, 68040.

crash - When a computer experiences an error which it cannot correct or a problem it cannot resolve, and it stops functioning. The only remedy is to re-start the computer. It gets its name from the common occurrence of bizarre ugly things that happen on the screen when the computer crashes quite thoroughly.

dead pixel - A pixel that is always black regardless of the intended color or brightness of the pixel.

debug - The process of finding the cause of a problem.

desktop - The metaphor used to describe the area in which the hard drive and Trash icon appear on the Macintosh. Just as a desk in an office has filing cabinets and a nearby trash can, the term is used to make a new user quickly understand the concepts of the Mac's interface.

digitized sound - Sounds recorded and transformed into a format that can be played back on a computer.

dither - Process in which colors or gray shades are combined in patterns to trick a viewer into thinking the monitor is displaying more shades of gray or colors than it really is.

driver - a program used by the computer and a device such as an expansion card or hard drive to properly communicate with one another. A driver is usually invisible to the user in that it is put into the machine by the piece of hardware that uses it; most hard drives and NuBus cards operate in this fashion. Some drivers take the form of a Control Panel Device to allow the user to modify the operating parameters of the hardware. The items selectable from the Chooser are also a special kind of driver.

expansion slot - A receptacle inside the computer used to connect boards which add a function not already provided by the computer manufacturer as a standard. These types of boards include monitor, communication, accelerator, and video input interfaces. Macintosh expansion slots have a variety of shapes and sizes. They include NuBus, '030 Direct (found in SE/30), SE Direct (found in SE), LC Direct (found only in the LC), Portable (found only in the Portable), Powerbook (found in the Powerbooks) and others on other machines.

floating point unit (FPU) - see math co-processor.

floppy drive - Magnetic mass storage media. These differ from hard drives in that hard drives contain a larger, inflexible, sealed platter on which information is stored. Floppies use a small, flexible, semi-exposed platter.

focus - Monitor clarity or "sharpness" measure. It has to do with how well the monitor can focus the electron beam into a very small round dot on the inside of the screen. This monitor measure has more to do with monochrome screens than it does with color screens, as the shadow mask on a color screen reduces the effects of poor focus.

fragmented - The state in which a hard drive is said to be in when it contains files which are stored in small scattered pieces on different tracks and non-contiguous sectors. This makes the hard drive work harder than normal (and slower) because it has to look all over the platter for the file pieces. There are various stages of severity, as there are few practical methods to prevent fragmentation. Utilities are available to "defragment" files, that is, put the file pieces together so they reside in contiguous tracks and sectors.

GPIB - Acronym for General Purpose Interface Bus. This is a standard interface used for high-speed data transfer. Typical use of this interface is with color scanners, color slide printers, and laboratory data acquisition. It is essentially synonymous with the term IEEE-488 bus.

gray scale - A collection of gray shades ranging from white to black. In the industry, this has become synonymous with the term "monochrome". Gray scale is a better appellation for this type of video in that technically monochrome also includes Black and White video (although it is not used that way in the industry) while "gray scale" specifically excludes Black and White video.

handshaking - Refers to the communication used to begin and continue a transfer of data between two machines or devices. The term is indicative of the devices agreeing to the conditions, such as line speed and protocol.

hard drive - Magnetic mass storage media. These differ from floppy drives in that hard drives contain a larger, inflexible, sealed platter on which information is stored. Floppies use a small, flexible, semi-exposed platter.

head - A device which reads information from and writes to any type of magnetic media (tapes, hard drives, floppy drives). Hard and floppy drive heads must glide back and forth across the surface of a disk's platter in order to go to the desired track and sector. The heads on a hard or floppy drive are similar to those found on a tape recorder but are smaller because they must be moved back and forth across the disk at high speed to acquire different pieces of data.

INITs - Generic term given to system software enhancements. These include useful utilities such as programs that add the capability to assign "hot keys" to any often repeated activity and mindless "stuff" like an INIT that shows an animated Oscar the Grouch rising from the trash can and singing after you throw a document away. Some of these INITs are poorly written and cause system crashes. A CDEV is a special type of INIT that has a window that allows the user to adjust various parameters associated with the operation of

the CDEV or a piece of hardware. All CDEVs and INITs are loaded in and activated during the final stages of the startup procedure of the computer. They often display an icon along the bottom edge of the screen while they are loading in.

interrupt - Event that stops all processing activities in a computer in order to concentrate all its energies on accomplishing a particular task. A good example of an interrupt is what happens when a key is pressed on the keyboard. The chip that talks to the keyboard sees that a key has been pressed and then interrupts the microprocessor so it can take the steps necessary to inform the program that is running about the key press. Other things that cause interrupts are hard disk activity, floppy disk activity, serial port activity, and an interrupt called the vertical blanking interrupt that happens exactly 60 times a second to allow for various system housekeeping actions to be performed. The two buttons on the Macintosh case, the restart switch and the "programmers key" also perform their magic via the use of interrupts.

logical address - When a program refers to a particular piece of data in RAM, it uses an "address" to name the location of the data it is after. The addresses a program uses are called logical address. In Macintosh computers there is also something called a physical address which refers to the electrical path to a particular piece of the computers memory. Because a Macintosh computer can have different sizes of memory SIMMS (i.e. 256K SIMMS, 1Meg SIMMS, 4Meg SIMMS, etc.), the electrical address (physical address) is usually different from the logical address for the same piece of data. The electrical addresses are in discontinuous "chunks" that correspond to the sizes of the SIMMS installed. The electronics of the computer "map" the messed up physical addresses to more usable logical addresses. This all happens at a low level within the system , and is invisible to the programs used by the user. This scenario is further complicated when Virtual memory is added to the machine. In this case, the logical addresses used by the programs continue to be all in one big simple chunk, but some of those logical addresses actually refer to physical addresses that are on the Hard Disk. When the program uses a logical address that refers to something that is temporarily sitting out on the disk, the system software reads the data in from disk (swapping it with something in memory) and then "maps" the logical address to the new physical address of the stuff referred to.

loopback plugs - plugs included with Snooper which make it possible for the two serial ports to "talk to themselves" when tested. They create a situation with each serial port somewhat analogous to placing a pipe between your ear and your mouth so that what you say gets piped right into your ear.

main monitor - The monitor which displays the menu bar. On a Macintosh that has more than one monitor connected to it, the system software of the computer includes a Control Panel which allows you to designate another available monitor as the main monitor.

mask (also shadow mask) - Directs the three separate electron beams (for red, green, and blue) to the correct color of phosphor dot on the inside of the monitor's glass front.

math co-processor - A processor chip which is optimized to solve mathematical problems at breakneck speed - typically much faster than the CPU can achieve by itself. Many models of Macintosh either include one of these, or make it available as an option. The Quadra computers use a new microprocessor called the 68040 which includes the functions of a math coprocessor within it, so no additional chip is needed for this function.

memory - see RAM.

microprocessor - see CPU.

MIPS - Acronym for Million Instructions Per Second. For example, a computer which is rated at 10 MIPS can execute 10,000,000 instructions each second. Unfortunately, the amount of work actually performed by an instruction varies greatly from one type of machine to another so this is not a very good measure of performance when comparing different types of machines.

modem port - see serial ports.

Monitors - Control Panel device which allows you to control the monitor configurations of your Macintosh.

monochrome - see gray scale and Black and White.

motherboard - The printed circuit board which contains all the necessary processing components of the computer including the CPU, RAM, ROM, and expansion slots. It is the big board that all the other stuff in the computer plugs into. Boards which plug into it are sometimes referred to as daughter boards. No explanation has ever been given as to why circuit boards are considered to be feminine. Many technicians believe it is because of their propensity for causing extra work (just kidding).

NuBus - expansion slot technology developed by Texas Instruments. It is used in all Macintosh II systems. It is also used in the Macintosh Quadra, although with speed enhancements - called NuBus '90. NuBus '90 is backward compatible with cards designed for use in the older NuBus specification.

oscillator - Used to generate high frequency continuous signals.

oscilloscope - An instrument that allows a user to "look at" the shape and size of electronic signals.

paged memory management unit - see PMMU.

parameter RAM (PRAM) - Small amount of low power RAM kept alive at all times by a battery. PRAM holds information such as the major Control Panel settings for mouse speed, target startup drive, speaker volume, and the background pattern for the Finder.

partition - This refers to a method of breaking a large hard disk up into separate parts or partitions. When this has been done with a disk drive on the Macintosh, each of the partitions shows up as a separate disk on the Macintosh desktop, even though the separate partitions belong to a single piece of hardware. The reasons for doing this would be for organization of data on the drive, file protection (you can often choose to password only certain partitions on the drive, thus limiting that data to only specific personnel) or maintaining more than one operating system (Mac OS and Apple Unix for example) on a single hard disk.

pincushion - Monitor irregularity where lines on the screen are bent in a fashion similar in appearance to a pincushion or whiskey barrel.

pixel - Concatenation of "picture" and "element". A dot - the smallest dot possible - on a monitor screen. If a monitor is said to have a resolution of "640 by 480", it contains 640 pixels across and 480 pixels down for a total of 307,200 pixels. The "depth" of a pixel refers to how much memory is dedicated to each pixel in the video driver circuitry. A deep pixel can have more variety in the color or brightness of the dot. Pixels that are only one bit deep can only show one color (usually white). The number of colors or shades of gray a pixel can show is the square of the number of bits "deep" it is. The pixels shown on one monitor all have the same depth, but a Macintosh can support several monitors each with different pixel depths.

platter - The physical piece of magnetic material in a disk drive on which information can be recorded magnetically.

PMMU - Acronym for Paged Memory Management Unit. A processor chip that is used to control the virtual memory operations of a Macintosh. Machines that have one use it to map and translate physical and logical addresses for the RAM in the computer. (see logical address)

PRAM - see parameter RAM.

printer port - see serial ports.

QuickDraw - The name given to the collection of graphics routines provided to developers and built into the ROM of every Macintosh. Developers need only to include a "call" to one of these routines, for example, to draw a rectangle on the screen. QuickDraw offers a consistent means for developers to quickly and easily add graphics features to their applications - and feel secure in compatibility. The quality and versatility of these routines built into every Macintosh is the major reason for the success of the machine in graphics related tasks.

RAM - Acronym for Random Access Memory. This is the area in the computer where stuff goes when it is read in from the disk. Programs and data are stored in RAM while they are being used. This storage is cleared out and lost when the machine is turned off. It is the 'scratch pad' of a computer.

Ram Disk - This is essentially the opposite of Virtual Memory. This would be used to speed up disk related operations by using some of the RAM as a "Virtual Disk". When this is available and being used, the system sets aside a portion of the memory and pretends it is a disk drive. The user can copy stuff to it just like he would a hard disk, but because it is in RAM, it is lightning quick. With the Apple version of Ram Disk, the storage that is set aside for the disk stays around through a restart of the machine, but does not withstand a shut down of the machine (or a power outage!). It is intended for temporary storage, with any important data to be copied back to the hard drive by the user before shutting down the system.

Real Time Clock - Chip in the computer that keeps track of the time and date.

ROM - Acronym for Read Only Memory. Contains the core set of instructions and routines that control many of the very basic functions of the computer. These include the procedures for system booting and much of the software that makes the Macintosh different from other computers. The stuff in this kind of memory is put in at the factory and cannot be changed by the computer. Because it cannot be changed, there is additional stuff on the disk called "system software" that gets loaded into RAM at startup. This method allows Apple to change the way things work and add features and fix bugs without replacing the ROM chips in the computer, while still retaining control of what types of machines its well protected operating system can be used on. The stuff on disk is worthless without the ROM chips soldered to the motherboard of each Macintosh.

sampled sound - see digitized sound.

SCSI - Acronym for Small Computer System Interface. A standard interface which allows a computer to communicate with up to 7 devices. SCSI devices are typically hard drives, scanners, CD-ROM drives, and tape backups. All Macintosh models since the Mac Plus have been equipped with a SCSI connection. The Macintosh Quadra sports an updated, backward compatible, and faster SCSI implementation called SCSI-2.

SCSI address - A SCSI device must identify itself by a number from 0 to 6 when connected to a computer in order to be recognized and usable. This number is its ID or address. If any SCSI device connected to a single computer uses the same address as another device on the same SCSI port, all devices with that address will be ignored by the Mac until assigned different addresses. In other words, each device connected must have its own SCSI address. This is usually changed with small switches on the back of a SCSI device.

sector - Think of this as a part of the circle defined by a track. The length of the piece of the circle varies from one disk to another, but it always corresponds to the length necessary to hold 512 bytes of usable data and some positioning and directory data on a Macintosh disk. If you held you finger above a spinning record, it would represent the disk drive head. The circle on the record that passes beneath you finger represents a track. A portion of that circle big enough to hold about 520 bytes of data would be a sector.

seek time - The time needed for a drive to find a particular track on a floppy or hard disk.

segmented (disk) - see fragmented.

serial ports - All Macintosh computers provide two serial ports: modem and printer. Both are asynchronous and can operate at speeds of better than 56Kbits/sec. Both can be used to connect certain peripherals (modems, printers, etc.) to the Mac or to connect the Mac to other computers on a network. They are called serial ports because the data that comes out of them is a series of bits, one at a time. A parallel port (such as SCSI) has several wires which each carry one bit of information. Thus, serial is slower, but has fewer wires and can be transmitted over a phone line. Parallel is better for short distance high speed communication.

SIMM - Acronym for Single In-line Memory Module. A small printed circuit board with memory chips soldered onto them to collectively provide RAM to the computer in which it is installed. Each SIMM can have different amounts of total memory, such as 256K, 512K, 1MB, 2MB, and so on, by using memory chips of appropriate densities. The SIMMs plug into slots on the motherboard, and must be - depending on individual model specifications - installed in groups of two or four modules. The sum of all the memory available on these SIMMs in a Macintosh (as well as any memory soldered onto the motherboard) is the system's RAM.

slot - see expansion slot.

stuck pixel - A condition where pixels that are supposed to be dark are white or some other color instead.

System 6.0.x - Collection of Mac operating systems whose only differences are slight alterations and bug fixes necessary to allow it to function with new CPU features. One example is the October 1990 introduction of built-in microphones on the Mac LC and IIsi. System 6.0.5 cannot handle the sound input while System 6.0.7 can. For all intents and purposes, all these revisions have been superseded by System 7.0.

System 7.0 - Macintosh operating system shipped May 13, 1991. This version sports many dramatic improvements over its predecessor, System 6.0.x. One drawback to the operating system, however, is its 2MB RAM minimum requirement to run. Without proper RAM amounts, software cannot run under System 7.0.

system clock - Provides a steady flow of electronic pulses with a quartz crystal to synchronize system activity. Each "tick" of the clock corresponds to a single *opportunity* for the microprocessor to execute an instruction. The speed of these pulses is measured in megahertz (million cycles per second).

system crash - see crash.

terminator - Used at the beginning and end of a SCSI chain of devices in order to prevent the electronic information traveling through the chain from reflecting toward its point of origin and interfering with the transmission of data. The configuration of these can often become a trial and error nightmare if there are several devices connected to the SCSI bus.

trace - The small thin "lines" made of copper on a circuit board. Each trace acts as a wire to connect two or more things together on the circuit board. The traces are actually made by starting with a board that is completely covered with a thin layer of copper. The space in between the traces is then removed by a photochemical process called etching. The traces are whats left over after the rest of the copper has been removed. The traces are both narrow (not very wide from one side to the other, like a thin line) and thin (not very thick from the surface of the board to the top of the trace.) Thus, they are very brittle and rely on the stiffness of the board to protect them from breakage. Sometimes the board is not stiff enough, or twists and warps slightly when it warms up and cools down. A trace broken in this way is almost impossible to detect visually because the break is so small.

track - Area on a hard drive, analogous to the grooves on a music record. Each track contains several sectors where information is stored. It refers to all of the data available with the head in one position. It is an imaginary circle on the surface of the disk, all of which is underneath the head during some part of the rotation of the disk. A single track is very narrow and hard drives have hundreds or thousands of concentric circles or 'tracks'.

versatile interface adapter - This chip handles all of the ADB communication. There is also another VIA in most Macintosh models that controls other hardware functions.

VIA - see versatile interface adapter.

virtual memory - Process in which available hard drive space is treated as though it was a set of RAM chips installed in the computer. Information is kept on the hard drive until it is needed by an application and is then swapped with something already in real memory. In order to make room in RAM for this requested information, the least-used data in physical RAM is moved to the “virtual” RAM on the hard drive. Due to the added time and sluggishness of hard drive access (when compared to physical RAM), virtual memory can be very slow. However, in a pinch, it can save the day if you need extra RAM in an emergency.

virus - Unlike a biological virus, a computer virus is actually something planned by a diabolical or stupid person seeking revenge or sadistic pleasure at the expense of others. A virus is a program that hides in the background of a computer (much like a driver, but with evil intentions). Much like safe sex, there tends to be some mystery surrounding the means by which computer viruses are transmitted. It is actually very simple. Computer

viruses are ALWAYS transmitted by running an apparently innocent program to which the virus is attached. An infected program can sit on your hard disk for years without spreading its curse throughout your machine as long as you don't ever run that program. This program could be either an application, or an INIT or CDEV. One of the first things the virus does, however, once it has been started by running the infected program, is to attach itself to other programs on your hard disk so that they too will now be sufficient to spread the virus when run. Thus even a "good" program from a respectable software company can infect your machine if you copy it from another machine that has been infected by a virus. The original source of a virus is almost ALWAYS a freeware or shareware program found on a bulletin board (a modem service that allows the user to get information and free programs), or a floppy disk passed along from one person to the next with a "neat new program on it to try". If you pay for every program that you run on your machine, your chance of getting infected with a computer virus drops almost to zero.

window - A window is any part of the Macintosh screen that shows information related to a particular task or menu item. There are a few different styles of window on the Macintosh, but all of them consist of some type of a border that defines the boundary of the window, and the content area of the window where the relevant data is displayed. There can be several windows displayed at one time, with all or part of one window covered by another window. The window which is in front of all others is said to be the "active window". It will always be the most recently selected or opened window, and any activity occuring on the screen will be in that window.

Index

P

Q

R

S

T

V

W

Z